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Development
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THE PAG BULLETIN

Purpose

The PAG Bulletin is published by the Protein Advisory Group of the United Nations System. Its purpose is to give information on the world protein problem to those individuals, academic institutions and industrial organizations which are interested in helping solve the protein problem and to promote the exchange of information in this field.

Mailing list

The PAG Bulletin is sent without charge to persons, organizations, and companies with an active interest in proteins. Requests to be added to the mailing list for the PAG Bulletin should be addressed to the Director of Secretariat, Protein Advisory Group of the United Nations System, United Nations, N. Y. 10017, U. S. A. Recipients are urged to share their copy with their colleagues.

Quotation

Permission to quote items from the PAG Bulletin is not required except from authors of signed articles. The Secretariat of the PAG would appreciate being informed of quotations made from the PAG Bulletin.

Suggestions

The PAG Bulletin will be successful only if it reflects all aspects of the protein problem comprehensively and objectively. The Secretariat invites suggestions and ideas for broadening and deepening the scope of the PAG Bulletin.

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NOTE

The reader's attention is drawn to page 45 where it is indicated that certain PAG Statements and Guidelines are now available in French and Spanish. In the near future, all the more important PAG documents of this type will be available in the three languages. The Secretariat will be pleased to respond to requests.

Le Secretariat tient à attirer l'attention des lecteurs sur la page 45 où il est indiqué que certaines déclarations et directives du PAG sont maintenant disponibles en français et en espagnol. Dans un avenir très proche, tous les plus importants documents du PAG de ce genre seront également disponibles dans les trois langues. Le Secretariat sera heureux de fournir ces documents sur demande.

Llamamos la atención de los lectores a página 45 y donde se indica que ciertas declaraciones y directrices del PAG ahora están disponibles en francés y español. En un futuro próximo, todos los documentos más importantes del PAG de este tipo serán disponibles en los tres idiomas. La Secretaría tendrá mucho gusto en responder a solicitudes.

REPORT OF THE THIRD MEETING OF THE PAG AD HOC WORKING GROUP
ON SINGLE CELL PROTEIN^{*}

The third meeting of this PAG ad hoc Working Group was convened at the Massachusetts Institute of Technology, Cambridge, Mass., on 1 and 2 June 1973, following the MIT International Conference on SCP which was held on 29-31 May 1973. The group prepared the following statements.

Suitability of SCP for human consumption

The world contains an enormous variety of so-called higher plants of which only a few can be consumed in unlimited quantities with no adverse subjective or objective reactions. Many more can and are eaten in moderate or small quantities with no difficulty. In addition, almost any plant food can cause an adverse reaction in some percentage of individuals in a large population. Such persons are usually aware that they cannot eat one or more of such common foods as wheat, strawberries, peanut butter, avocados, and the like, yet the frequency of adverse reaction to such foods is sufficiently low that the products need not be banned from human diets. What is required, however, is that the susceptible individuals be able to identify such foods in order to avoid them. With fruits and vegetables, this is generally not a problem, but it is very important that foods containing peanut meal, for example, be so labelled.

There are many ordinary or conventional plant foods, in very common use today, which would not be approved if submitted to a national regulatory agency for clearance as a new food; rhubarb is a possible example. In addition, the substrates on which higher plants grow may introduce problems in one region that are not seen in another; for example, soil with an excessive content of selenium. Finally, at any stage of the growth, storage, processing and distribution of

conventional plant foods, environmental circumstances can render them unacceptable or unfit for human consumption. These include contamination by pesticides, rodents, bacteria and molds and simple spoilage, heat damage, etc.

Consideration and selection of SCP organisms, substrates, processing conditions, etc., are entirely comparable to those for higher plants. Problems arise because man is trying to compress into a few decades for SCP a process of selection and testing that for higher plants has extended over millennia. The principal exceptions to this statement are illustrative and encouraging:

- a) The wide variety of fermentation processes that have been used for centuries by mankind indicate that many microorganisms and products of microbial growth are beneficial to man; and
- b) The extensive favorable experience with the use at modest levels of properly-prepared food yeast. In at least a dozen experiments food yeast has been fed without difficulty at levels of 100 grams or more per day. Problems that have arisen with regard to the acceptability of some yeast materials should be kept in proper perspective against this background. In each such case, there was no reason to believe that the problem was inherent in the cell, but rather was likely to have been an artifact related to the way the material was produced or handled.

It is just as illogical to argue that because many microorganisms are unsuitable for human feeding, all microorganisms are suspect, as it is to argue that because many higher plants are unsuitable for direct human consumption, all are suspect. It would be

^{*} One portion of this report, "New information from the MIT Conference on Single Cell Protein", was published in PAG Bulletin, Vol. III, No. 3, page 27. This is the balance of the report, which is also available in single copies from the Secretariat.

equally illogical and unwise, however, to make the reverse assumption in either case. There is simply no substitute for the systematic screening of all SCP materials in domestic and farm animals. Although a material can be fed at practical levels to animals, it cannot necessarily then be fed indiscriminately to humans without further testing. Even careful tests in experimental animals cannot provide absolute assurance of safety for human use.

The discussions of the ad hoc Working Group at its Cambridge meeting indicated two conclusions:

- a) A variety of safe, palatable, nutritious and economically feasible SCP products can be developed for human consumption; and
- b) Not all of the SCP products which meet all of the requirements for use in animal feeding will also be found suitable for human food use.

The development of SCP for human consumption requires thorough and systematic evaluation which may require a period of years. It will begin with organisms already demonstrated to be suitable for practical feeding of animals destined for early slaughter. The next step will be to ascertain the suitability of such material in regard to reproduction in poultry and to reproduction and lactation in mammals. It will then extend to experimental studies at the highest feasible level of feeding in such experimental animals as rats, dogs and monkeys. There should also be specific teratogenic and mutagenic studies in pregnant animals and short-term feeding studies to determine acceptability and nutritional value in healthy human subjects.

Finally, relatively large human test populations, i. e. several hundred persons, should be exposed to the material for long enough to determine the frequency of idiosyncratic reactions of some individuals to the material. Only after these steps have been completed is one justified in marketing any new SCP product for human food use regardless of its substrate or species.

Feasibility of SCP production in developing countries

From data previously available to the group and the reports and discussions of the Second International Conference on Single Cell Protein held at MIT, 29-31 May 1973, it was concluded that development has reached a point where large-scale commercial production of SCP from carbohydrate, hydrocarbon or petrochemical substrates is economically and technically feasible. At the present time, this is established for animal feeding in industrialized countries which have a rising demand for animal protein and an increasing dependence on imported feed. There are reasonable prospects, however, that there will also be a demand for SCP for human consumption within a few years.

As for the economic feasibility of SCP production in the developing countries, no categorical statement can be made at this time. There may be exceptional circumstances in which the capital, the resources and the markets exist for producing SCP on hydrocarbons or petrochemical substrates, but for the majority of developing countries it is extremely unlikely that SCP can compete with more conventional sources of animal feeds or that it can be sufficiently low in price to provide a useful source of protein for human consumption. Consideration needs to be given in selected situations to SCP grown on various carbohydrate substrates, such as molasses, cassava or vegetable waste, that might be more economically feasible. For any individual country, each proposal requires a specific evaluation, to be made on the basis of local economic considerations including production costs, internal and external markets, direct and indirect benefits for the country and the priority of SCP relative to other needs and investment opportunities.

Correction of protein values of SCP in relation to nucleic acid content

The group reviewed the problem in biological determinations of nutritional value of single

cell proteins due to the presence of significant amounts of nucleic acids whose nitrogen content is included in routine determinations of crude protein.

A significant fraction of the nitrogen in micro-organisms is contributed by nucleic acids and is thus largely unavailable for protein synthesis in man. Calculation of the crude protein content ($N \times 6.25$) therefore overestimates the true protein content of SCP. On the other hand, the net protein utilization (NPU) of SCP is underestimated in comparison with that of other protein sources. Thus, the net protein value represents a more accurate estimate of the nutritive value of SCP. It is calculated by multiplying the protein content by the NPU*.

Collaboration with other international groups

Advantage was taken of the presence at the meeting of representatives of the International Union of Pure and Applied Chemistry (IUPAC) and of the European Economic Community (EEC) to discuss the desirability of closer PAG collaboration with these and other groups similarly concerned with problems in SCP. The group offers the following proposals to the PAG:

a) PAG collaboration with IUPAC

i) In the development of SCP, close collaboration between PAG and IUPAC is desirable because a) IUPAC, through its Fermentation Industries and Food Sections, advises on questions concerning analytical methodology and standards of quality and identity in developing the commercial production of SCP for animal feed and eventually for human food; b) IUPAC relies on PAG for advice on matters related to the biological assay of novel protein products; and c) cooperation between IUPAC and PAG can assist PAG to fulfill its advisory role to those UN agencies concerned with the development of SCP and with advising governments on the subject.

ii) The group's composition should, at future meetings, include specialists in animal husbandry, animal nutrition, food and feed technology, economics, etc.

iii) It is undesirable to multiply the number of advisory groups dealing with this question. Therefore, it is proposed that IUPAC and agencies with similar interests, such as Codex Alimentarius, should be invited to send a representative to each meeting of the SCP ad hoc Working Group.

b) PAG collaboration with EEC

In the light of the 1972 draft EEC Council Directive dealing with harmonization of the laws of member states concerning natural yeasts and yeast residues, and the 1971 recommendations of the UN Economic and Social Council Strategy Statement on Action to Avert the Protein Crisis in the Developing Countries, the ad hoc Working Group considers that close collaboration of PAG and the Commission of the European Communities (CEC) is highly desirable.

In particular, in the formulation of new legislation, the EEC should be asked to take into account the PAG guidelines dealing with the purity and sanitary requirements for SCP produced from either conventional or unconventional substrates.

The ad hoc Working Group proposes that Professor Senz be designated as the official PAG liaison representative to the CEC, in order to promote effective coordination between CEC and PAG and to make available and to interpret to CEC pertinent PAG conclusions and recommendations.

In addition, the Secretariat should develop and provide to the ad hoc Group, at a future meeting, a summary of the pertinent regulations of EEC and its Member States relating to the approval and marketing of SCP and other novel protein foods or feed materials.

* See PAG Guideline No. 6.

Recent developments in Spirulina

From information provided to the group by Mlle. Clément of the Institut Français du Pétrole and by Prof. Senez, the following report and recommendations were prepared.

The French Delegation Generale a la Recherche Scientifique et Technique (DGRST) has initiated a two-year research program to study the nutritional value, toxicity and acceptability of Spirulina. This program, the financing of which amounts to 1 million francs (about US \$200,000), was undertaken by a number of official laboratories belonging to universities, the National Institute for Agricultural Research (INRA), the Overseas Institute for Scientific and Technological Research (IRSTOM), and the Institut Français du Pétrole. It includes fundamental research on the physiology and chemical composition of Spirulina and both animal and human experimentation.

At a symposium held recently in Paris, 23-24 May 1973, the preliminary results of the studies carried out in France were reported and discussed jointly with results of a series of other studies performed in Mexico by Mexican governmental institutes and the Sosa Texcoco Company. A final report of this program is now in preparation and will be issued before the end of 1973.

The consumption of Spirulina by populations surrounding Lake Chad has now been carefully studied. Average intakes were found to be 6 to 7 grams per person per day, incorporated into bean sauce, or 10 to 12 grams as Spirulina sauce. The average frequency of use was four times a week. Maximum consumption was the equivalent of 26 grams of dried Spirulina daily. Spirulina was estimated to provide less than 1% of the caloric requirement, but 3% to 8% of the protein intake. As income improves, consumption is found to drop.

Historical records indicate that Spirulina was consumed by the Aztecs in the form of sun-dried cakes, but the quantities are unknown and there has been no such use of Spirulina in Mexico in recent times.

a) Chemical composition of the Spirulina cells

The Spirulina are prokaryotic blue-green algae, belonging to the group Cyanophyceae. They have many characteristics in common with the bacteria, to which they are closely related. However, the photosynthetic properties of these organisms are similar to those of the green eukaryotic plants, as they have a chlorophyll of the α -type, contain phycobillins and possess a photosynthetic system of Type II, leading to the photochemical evolution of oxygen.

The protein content of the dried cells varies between about 64% and 74%. The amino acid composition can be considered as satisfactory, despite a slight but consistent relative deficiency in lysine and histidine.

The total nucleic acid content amounts to 4.25% of the dry weight. The nucleic acid base ratios are consistently different for Spirulina platensis from Lake Chad and for Spirulina maxima taken from Lake Texcoco in Mexico. The adenine plus thymine/guanine and/cytosine ratios are 0.61 and 0.43, respectively. Because this indicates that these two strains belong to two taxonomically different species, the nutritional assays performed with one of these strains cannot be considered as wholly valid for the other.

Certain other constituents of the cells seem to have significant importance and nutritional interest. They are rich in carotenoids, 80% of which are β -carotene, and contain fairly high quantities of cholesterol. The cells also contain a large variety of saccharide components, including, besides common hexoses, a glucane highly resistant to acid and enzymatic hydrolysis and 2 to 3% (on dry weight) of mono- and poly-phosphorylated mesoinositol.

Analyses performed by Drs. Bories and Tulliez at INRA have shown the accumulation in Spirulina cells of 0.1% to 0.3% of alkanes, contributed predominantly by normal heptadecane. Experiments performed by these authors have shown, after 16 weeks of administration of Spirulina cells to rats, an accumulation in the adipose tissues of these

animals of 400ppm of heptadecane. Benzo-pyrene concentrations were found to vary from one sample of Spirulina to another, being between 2.6ppb and 3.8ppb. No significant amounts of heavy metals have been found.

b) Feeding tests

Animal feeding experimentation has been conducted with a variety of Spirulina samples of various origins and processes, including:

i) Spirulina from Lake Chad treated by traditional processing, i. e. sun-dried on sand. These samples contained fairly large amounts of sand and some of them were contaminated by a great number and variety of bacterial cells.

ii) Spirulina experimentally cultivated at IFP on artificial synthetic media and freeze-dried.

iii) Spirulina harvested by the Sosa Texcoco Company in Mexico and drum-dried. This type is the product currently commercialized in Mexico for human consumption.

The assays have also included Spirulina previously decolorized by two different procedures: a) a French process using exhaustive extraction with a mixture of 80% ethanol and 20% acetone and b) a Mexican procedure using ethanol extraction only. Despite this, there is an unfortunate tendency to speak of the tests on rats, chickens and swine as if referring to testing a single product. The apparent digestibility of the various samples is consistently lower than that for protein of animal origin, but is not inconsistent with that for other plant proteins.

Experiments with pigs, performed by Dr. Février at INRA, have included assays on both weanling piglets and young females. In the weaning diet, Spirulina provided only 25% of the total protein, with the remainder from milk. Even at this proportion, "... the utilization of the Spirulina diet was lower than that of milk, especially during the first two weeks, but later on becomes equivalent to that of milk". The experiments with the young females gave good results, but the diet contained only 5% of Spirulina cells.

The results of assays performed by Drs. Calet and Blum with chickens were unsatisfactory. When the Spirulina provided 12% or more of the total protein in the diet, growth was consistently retarded and the effect was especially marked for young chicks aged 0 to 4 weeks. This was confirmed in two series of experiments, in which the chicks were completely deprived of protein and then fed a reference protein diet with increasing proportions of Spirulina. When the proportion of Spirulina was 20% or more, weight gain was slowed.

Nitrogen balance studies were carried out on ten children, aged 5 to 12 months and hospitalized for severe protein-calorie malnutrition, by Dr. Ramos-Galvan in Mexico. The children received alternately Spirulina from Sosa Texcoco and soy, which supplied 115 ± 15 calories and 2 to 3 grams of protein per kg of body weight per day for balance periods of 4 days. The absorption of nitrogen was 60% for the Spirulina and 70% for soy, but the retention was higher (40%) for Spirulina than for soy (30%). Expressed as per cent of ingested nitrogen retained, the results were 42% for breast milk, 34% for cow's milk, 24% for Spirulina and 20% for the soy preparation used. These results are reasonably satisfactory, but in 5 of the 10 children, absorption of Spirulina was less than 50% and a positive balance was not obtained at the levels that could be fed.

Drs. Sautier and Tremolieres in France have given Spirulina protein to two adult females with anorexia nervosa and severe protein malnutrition. The Spirulina represented $1/7$ or $1/4$ of the total protein nitrogen and the results were consistently similar to those with control diets.

Acceptability. A number of prepared foods containing about 2% Spirulina have been tested for human acceptability in Mexico and in France. In Mexico, some of these preparations have been accepted, but in France the results have been negative. While acceptability is slightly improved by decolorization, this treatment does not suppress the characteristic unpleasant taste.

In Mexico, one of the more acceptable uses of Spirulina was to fortify cereals. However, because of the relative deficiency of lysine, histidine and tryptophan in Spirulina, the improvement in protein value is minimal.

c) Conclusions

The Working Group concluded that Spirulina might serve as an acceptable source of protein for either animal or human feeding under some circumstances but that the quantities which could be usefully incorporated were likely to be limited. The Spirulina now produced by Sosa Texcoco in Mexico contains a considerable mixture of organisms. There is no information on the distribution of various microorganism types in the dried product or on the variability of their distribution over either short or long periods of time.

Even after drying, the final material was reported to contain 1,800 viable anaerobic bacteria per gram, small numbers of Streptococcus fecalis and some hydrogen sulfide producers.

For clinical trials of this or any other SCP material, the Working Group emphasized that before it is employed for human consumption it is essential that a sufficient supply of standardized product be assured and that the requisite animal tests be conducted on this standardized product. Any material fed to human subjects should be derived from the same lot of standardized product on which the tests have been completed in experimental animals. By these criteria it is clear that any authorization for human consumption of the Spirulina material presently produced by Sosa Texcoco in Mexico would be premature.

Additional studies are required to ensure the standardization and quality of this material. It should be noted that biological studies of the nondecolorized material cannot be assumed to apply to material treated to remove the color. The solvent extraction process employed for decolorization results in a different product with the possibility of significant chemical and biological alterations.

In summary, until there is a standardized product which can be assured to be free of unacceptable variability or contamination and until systematic analytical and biological studies have been completed on this material, industrially-produced material should not be recommended for human consumption. This judgment would not apply, however, to traditional food use of Spirulina among subsistence populations such as in Africa.

National acceptance of SCP

The Working Group was informed of the recent development in Japan where the use of the name "petroprotein", combined with a wave of concern for the pollution attributed to the petroleum industry plus other factors, has temporarily forced cancellation of programs and plans for producing SCP for animal feeding. The Working Group reemphasized that a number of SCP products, including those grown on a substrate containing petrochemicals, can meet stringent criteria for safety and nutritional value and can be produced under conditions which protect the environment.

The use of a term such as "petroprotein" is highly misleading to the public because it does not convey either the fact that chemically-pure substrates can be employed or that the protein is synthesized by living cells rather than by artificial methods.

There are a number of ways of minimizing difficulties in obtaining public acceptance of SCP. These include avoidance of names with potentially negative connotations; detailed analytical, microbiological and biological evidence of safety and effectiveness before claims are made; and presentation of information to the public in a responsible and educational way. Where human food use is intended it is essential that extensive clinical as well as preclinical testing precede public announcements. If SCP producers and governmental agencies in various countries scrupulously follow the PAG Guidelines, they will be better able to answer criticisms and doubts.

The PAG should not hesitate to give its

endorsement to any specific SCP material which can be demonstrated to meet all of its requirements, but it cannot give generic approval to SCP for either animal or human feeding. Each SCP product must be judged on its own merits regardless of the variety of

organism or type of substrate involved. International organizations, governments, ministries and private industry should be encouraged to discuss SCP problems with the PAG Secretariat, particularly in regard to the application of PAG Statements and Guidelines.

PAG STATEMENT (No. 26) ON FOOD AND NUTRITION CONSIDERATIONS
IN NATIONAL ECONOMIC PLANNING^{*}

During the last few years, FAO, WHO and UNICEF and the USAID have taken a number of steps to encourage interested governments to initiate nutrition planning as a systematic process linked to the overall development planning mechanism. These steps include the preparation of guidelines or handbooks, the organization of workshops and seminars and other activities designed to emphasize the multidisciplinary and multisectoral character of nutrition programming. All these efforts have emphasized the need for providing an analytic basis for decisions on priorities to be established for food and nutrition and on selection of strategies. Some governments, for example those of India and Brazil, have moved rapidly in the direction of incorporating nutrition objectives into national economic and social planning and in mounting specific programs reflecting the high priority accorded to improving nutritional status.

In most low-income countries nutrition program activity appears to receive relatively little attention from planners and is characterized by small-scale and fragmented efforts. This appears to be due in part to a lack of awareness on the part of political leaders and administrative officials of the significance of malnutrition for development and the absolute insufficiency of total budgetary resources. Even where domestic and foreign financing have been made available for food and nutrition programs, such

programs often miss the most vulnerable groups and because they are frequently on a token scale, they offer little prospect for consequential nutritional impact, replication or expansion. Without a government decision to adopt and finance a comprehensive national nutrition strategy, expenditures on nutrition on an ad hoc basis may be of questionable value.

Since improvement in nutrition is directly related to increases in family income, due emphasis needs to be given to accelerating economic growth as an effective means of changing nutritional status: improving agricultural productivity among small farmers, encouraging agroindustry in rural areas for food conservation and processing, generating jobs and other measures which will increase the income of low-income groups. At realistic rates of growth, it is recognized that a nutrition strategy of this kind can, in the long run, significantly improve the position of low-income families who are generally the most vulnerable to the adverse effects of inadequate diet. A number of countries, however, are increasingly active in examining specific nutrition program possibilities, particularly with respect to children under age five and pregnant and nursing mothers, based on their desire to accelerate nutritional status changes and their desire to accelerate nutritional status changes and their unwillingness to rely entirely on the results of overall economic growth. Even

^{*} Statement prepared at the 21st PAG Meeting, New York, 4-8 June 1973.

in those countries which are prepared to accord a high priority to nutrition planning, there is often an absence of clearly formulated objectives without which it becomes impossible to design investment strategies for food and nutrition or to measure the effectiveness of investments which have already been made.

Nutrition planning may be unrealistic unless it addresses itself to special problems in particular regions within a country and to identification of feasible means to reach specific target groups. While availability of data represents a constraint on effective planning, there does exist in many countries information from a wide variety of sources which could be effectively organized and utilized. Indeed, the planning process itself will identify specific data gaps which need to be filled and this can serve as an efficient mechanism for initiating the collection of required information.

While the long-term planning policy is under way, a government concurrently can and should initiate useful operational projects to meet immediate and obvious needs. This experience in operating nutrition projects will in turn enrich and make realistic the long-term planning process and will generate important information for the planners if evaluation mechanisms are built into such projects. Further, a commitment to systematic nutrition planning will facilitate building nutrition components into agricultural, health and education projects and will stimulate planners in these sectors to consider the nutrition implications of projects and programs which

are being considered. Thus, the adoption of a specific nutrition objective will require adequate allocation of resources and this may in certain circumstances be achievable by reallocation of existing resources. In the health sector, for example, a redesign of the health-care delivery system to accomplish by nutritional means a more efficient disease prevention program may be preferable to investing in conventional programs. The same possibilities exist in the education sector and in the agriculture sector. In essence, with objectives which state, wherever possible, quantitative targets for accomplishment within a specified time frame, it becomes possible to identify the financial and program trade-offs affecting decisions on increased investments in preferred intervention programs.

While the desirability of encouraging systematic long-range nutrition planning and short-range operating programs in a mutually-reinforcing manner exists, there is an urgent need to develop guidelines useful to planners giving a definition of malnutrition, measuring its magnitude, assessing its significance to social development, possible programs which a country could consider (especially drawing attention to causes of failure in the past), and an outline of possible criteria and means of measuring the effectiveness of ongoing food and nutrition programs. A "common language" - commonly-adopted terminology - in the field of food and nutrition problem-solving must be developed to facilitate governments in making decisions and to assist UN agencies and other organizations providing support to such governments.

NUTRITIONAL REHABILITATION CENTERS*

The Protein Advisory Group had the opportunity of reviewing the present situation and performance of nutrition rehabilitation centers currently in operation in several areas of the world for the

treatment of malnourished children. It was noted that in recent years, many countries have established centers of this type in order to alleviate severe cases of PCM and to educate the actively-participating mothers in

* The views of the PAG as expressed at the 19th PAG Meeting, Geneva, 1971.

the nutritional rehabilitation of their children.

The Group concluded that in areas with a high prevalence of protein-calorie malnutrition in young children, the centers were in fact a useful means for reducing mortality and morbidity rates. Although severe PCM with complications requires urgent treatment in a hospital, most cases of malnutrition, even of severe forms without complications, have been successfully treated in nutritional rehabilitation centers. The number of relapses has been fewer than at the hospital level. Moreover, the cost of the recuperation of the child in the centers is only about 8% of that for hospital treatment. The Group emphasized, however, that the nutritional rehabilitation centers should always be a part of a more comprehensive maternal and child health program and should not operate in isolation. The distribution of food should be accompanied by nutrition education activities in order to maximize the effect of the program.

Recent experience has indicated the value of nutrition rehabilitation centers in emergency situations. Experience has also shown that they produce a substantial favorable change in the attitude of doctors, and more importantly of public health workers, towards nutrition problems and programs. The centers have also been considered as useful tools for training public health personnel and community workers. The centers have been utilized for the study of the epidemiology of malnutrition and for the introduction and study of new procedures and techniques for nutritional and psychological rehabilitation. They have also attracted the interest and involvement of both the beneficiary community and the elite among the people.

The Group recognized, however, that the nutrition rehabilitation centers have some limitations; for instance, they are usually not applicable to the treatment of children under one year of age who often require special medical and nursing attention. Also, their operation is difficult in rural areas with a scattered population.

The PAG endorsed the views expressed in the

report of the PAG ad hoc Working Group on Feeding the Preschool Child on nutrition rehabilitation centers, which follows. It was stressed that the centers should not be considered as a panacea for combating childhood malnutrition in the population but only as a link within the network of activities for the control of malnutrition in the community. The efficiency of the centers in educating mothers regarding dietary requirements also needs to be improved. Some of the failures which have been found in some areas of the world are due more to the inappropriate training of the personnel in charge of the centers than to the philosophy of the method. Attention was drawn to the fact that, although the centers should receive a minimum of supervision from physicians or public health nutritionists of the health service of the area, the main responsibility for the operations should be in the hands of auxiliary personnel who have received adequate training.

The PAG emphasized the need for more studies on the nature of nutrition rehabilitation centers as opposed to other alternatives in the control of malnutrition, particularly in the treatment of malnourished populations. For instance, there are some possibilities of treatment of malnourished children at home through supervised supplementary feeding or by providing foods to the whole family for a period of time. These alternatives are promising and the PAG recommended that operational research be undertaken in order to study the comparative cost benefit of rehabilitation in the centers, in the hospital and in the homes of malnourished children with proper medical supervision. Such evaluation should consider not only the physical improvement of the malnourished children but also the beneficial impact on the community as a whole.

Local availability of appropriate foods is a critical factor in obtaining maximum long-term benefits from the operation of nutrition rehabilitation centers. Although ideally other projects and programs would deal with this problem adequately, in some cases it may be necessary for the nutrition rehabilitation center to be involved.

Extract from the report of the PAG Working
Group on Feeding the Preschool Child
(Document 1.14/27)

"Nutrition rehabilitation centers, which are known in some countries as 'mother-craft centers' or nutrition education and rehabilitation services (NERS), are directed at improving the nutritional status of malnourished children in the community and at educating parents in preventing malnutrition in the family. They must, however, not be confused with centers often operating under the aegis of social welfare agencies, also known as mothercraft centers in many countries, which may educate mothers generally in housecraft and child care but do not deal with the feeding and rehabilitation of malnourished children.

"Activities. Two main types of rehabilitation centers exist, the domiciliary type often attached to a hospital and the day-care type of center. In both instances the children are fed with nutritious local diets prepared, under suitable instruction, by the mothers. It has often been found that mass distribution of food commodities to families does not necessarily affect the nutrition of the target group. For this reason, the use of rehabilitation centers may prove more effective. However, perspective is required when using these centers; they are not a panacea to childhood malnutrition in the community.

"The emphasis given to them will differ within countries and with the local community pattern of malnutrition. In some countries, in addition to nutrition rehabilitation centers, other types of nutrition services have been established, such as food demonstration units, nutrition centers and dining rooms for preschool children. These are utilized for nutrition

education of mothers and distribution of food supplements to young children.

"Evaluation. The nutrition rehabilitation centers have been found useful in times of emergency (Biafra, Bangladesh refugees in India) and when the point prevalence of malnutrition in a community is high (Haiti). Although there is a need for careful evaluation of their cost and replicability in a given community they are in fact cheaper than the hospitalization of the malnourished child and reduce the cost of the convalescence period. (US \$7 to \$15 a day in a pediatric hospital bed to US \$0.40 to \$0.70 per child in the nutrition rehabilitation centers). However, different inexpensive methods need to be devised to deal with malnutrition in different ecologies. Apart from their primary function, these centers are also an excellent educational tool at many levels. They are useful in persuading and convincing the medical establishment and classical nutritionists of the effectiveness of simple approaches to treating and preventing malnutrition in pre-school children. They are often of great help in diminishing the pressure on scarce hospital beds and achieving the needed nutritional rehabilitation at a reduced cost. They are also excellent centers for training of physicians, nurses and paramedical personnel working in the field. They will awaken in the community at large an awareness of the existence of malnutrition in their midst and its causes and encourage community participation in the solution of the problem.

"Nutrition rehabilitation centers are a useful component of a general network of services, which are all aimed at preventing and treating malnutrition in the vulnerable preschool child group."

A NOTE ON REQUIRED LEGUME RESEARCH*

With recent improvements in productivity of wheat and rice, and to some extent maize, pearl millet and sorghum, there are reasonable hopes that the demand for calories can be more or less satisfied. The prospects of meeting the demand for protein are, however, less bright unless concerted action is initiated. The economics of the plant-animal-man food chain is, for many developing countries, quite unfavorable. While the population is expanding and is expected to double in the next few decades, the limits of increasing land under cultivation have been nearly reached. Greater reliance, therefore, must be placed on the direct chain from plant to man.

Pulses, which are the dried seeds of some leguminous genera, will have to play an important role in meeting the protein needs of these countries. Fortunately, dry legumes have been popular in the diets of the people and acceptability will not be a problem. Pulses also possess other advantages: a) they make a substantial contribution to energy needs; b) they contain 2-3 times as much protein as do the cereals; and c) perhaps most importantly the amino acid profile of pulses complements that of cereal proteins so that a diet containing proteins from the two sources can satisfy man's requirements for the essential amino acids. Since legumes have the capacity to fix atmospheric nitrogen symbiotically, pulses form an important component of a productive farming system. Pulses are also known to improve the crumb structure and moisture retention of the soil.

Ironically, the very success which attended efforts for improved productivity of cereals has adversely affected pulse production in countries like India and made it subject to wide fluctuation. When land comes under irrigation, pulses give way to high-yielding cereals and are pushed into more marginal lands. While this may have been partly due to the concern of the government for increasing cereal production, there is no denying the

greater economic returns obtained from the new varieties of cereals, especially wheat. Any attempt at increasing pulse production will succeed only if their productivity is increased so that they are more competitive, vis-à-vis cereals, than now.

Increasing the genetic potential for seed yield

The fundamental reason for cultivating any crop is to exploit its ability to capture radiant energy and convert a high proportion of this into useful economic products; these are carbohydrates and proteins in the case of pulses. At present, we lack effective solutions to the many interrelated problems involved in obtaining a high production of them from pulse crops. It is essential, therefore, to devise ways and means of increasing considerably the genetic potential inherent in pulse varieties to capture and convert radiant energy into useful end products. The role of environmental and cultural factors in determining the extent to which these potentialities are actually realized in practice also need to be better appreciated, evaluated and controlled.

Improving photosynthetic efficiency. Physiological studies on pulse crops are rather meager but such studies on other legumes such as soybeans, groundnuts, etc., may be relevant. These studies have clearly shown that legumes reach light saturation at a fairly low intensity. This may be a reflection of their evolutionary history since legumes probably developed in less open country than cereals. Their inability to make use of higher light intensities may also be due to the greater photorespiration in legumes as compared to cereals. However this may be, a search for greater photosynthetic efficiency and a greater capacity to utilize abundant sunlight is likely to be rewarding. The basic research needed for accomplishing this must get top priority.

A more immediate possibility would appear to be to restructure the architecture of the

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leguminous plant so that maximum use is made of the available sunlight. In soybeans, for example, it has been found that only the top 15-30cm of the canopy is sufficiently illuminated while the leaves deeper than this are highly shaded. A restructuring of the canopy so that a greater part of it receives sufficient energy can result in high yields. Theoretically, the maximum yields can be obtained when the most shaded leaves are at the compensation point; opening up the legume canopy by selecting for smaller, more erect leaves could, therefore, result in greater yield potential.

Improving the sink potential. The sink potential assumes importance in realizing the greater yield potential of the end product, the seeds. It is known, for example, that only 20% of the sugar synthesized by the plant is recovered in the seed in a moderately high-yielding crop of soybeans. A program aimed at increasing the sink capacity may be of help in harvesting in the seeds a greater portion of the energy fixed by the plant.

One of the reasons for such low recovery may be continued vegetative growth, since most legumes are indeterminate. Reduction of vegetative dominance by breeding determinate types, closer planting, hormonal treatment, etc., could lead to a greater recovery of the photosynthetic products in the seeds. Also any reduction in flower and young pod drop, which has been estimated to be as high as 75%, could obviously increase the available sink capacity. Since random removal of flowers does not lead to any reduction in the abscission of remaining flowers, it has been suggested that competition for photosynthate may not be the major cause of such flower pod abscission. The greater shading of the inflorescences due to the closed canopy may perhaps play a major role or it may be a reflection of moisture stress caused by the continuing demands of the vegetative parts, a particularly important aspect as long as pulses are grown as dry-land crops. Considerable investigation of such flower drop appears essential.

Improving the nutrition of pulse crops

Pulses have been shown to respond to

application of phosphorus (P) and potassium (K) just as other crops do when these elements are lacking in the soil. This is fortunate as both synthesis and utilization of sugars need adequate P and K. The other major element, nitrogen (N), primarily influences the utilization of the sugars. Pulses derive by far the major part of their nitrogen from symbiotically fixed nitrogen made available by the bacteria in root nodules. There is considerable evidence that application of nitrogenous compounds in earlier stages inhibits symbiotic nitrogen fixation. From the economic point of view also, it would appear desirable to exploit symbiotic fixation of nitrogen rather than add extraneous nitrogen fertilizers which are already in short supply. The desirability of developing more efficient symbiotic systems of legume and rhizobium thus assumes prime importance. The nitrogen required for the synthesis of protein in the seed obviously depends on the nitrogen fixation by the plant and the symbiotic association has an important role in this. The relation between the strain of Rhizobium and the variety of legume is known to be very specific. This relation is affected by interaction with soil type, soil acidity, organic matter, various minerals, etc. A 60 quintal/hectare crop of pulse, for instance, would result in a harvest of about 550kg N in the plant parts, which is very much higher than the amount fixed by rhizobia. It may be possible to breed legume varieties with greater productivity potential through increased specificity of superior nodule serotypes.

Another aspect of this problem which also needs attention is the possibility that if pulses are provided with a greater supply of nitrogen, yields could be increased. It has been suggested for instance, that the sharp drop in photosynthetic activity of pulses (noticed almost universally in legumes) with the onset of the reproductive phase could be traced to reduced N supply. Such reduction in N supply might in turn be responsible for the sloughing off of root nodules, possibly a result of competition for the reduced photosynthate pool, resulting in N availability. It may be noted that such sloughing off of nodules does not occur in tree legumes. The interesting possibility then arises that if nitrogen availability could be increased this chain of adverse events could be

avoided and high yields realized.

There are two possible approaches. One would be to search for genotypes of legumes and rhizobia which would permit a complementary utilization of artificial and symbiotic nitrogen. The interesting question is whether a careful scrutiny of wild germ plasm at the putative centers of origin of different legumes would reveal the existence of such genotypes of the host and/or the symbiont or alternatively, could such genotypes be produced by induced variation.

A second approach would be to discover whether nitrogen could be applied at some stage of the host-plant development without causing preferential utilization of artificial nitrogen in preference to symbiotic N or affecting the process of symbiotic N fixation. This may be a fairly complex question and may be resolved only with sophisticated experimentation. Again, whether such additional N will be reflected in increased seed yield or only induce more vegetative development which would compete with seeds as sinks for available photosynthate may need to be worked out empirically and methods for avoiding this developed.

Improving the nutritive value of pulse crops

The PAG Statement No. 22 on upgrading human nutrition through the improvement of food legumes has clearly stated the need and scope for quality improvement in pulses. The major nutritional importance of pulses lies in their protein content. An obvious approach would, therefore, be to seek to increase their protein content by selection in existing variation or induced variation. Relatively little work has been done to bring about such an increase in the protein content of pulses. However, the relatively greater success achieved in increasing the protein content of cereals and the oil content of legumes such as soybeans and groundnuts suggest that there may be a possibility of selecting for higher protein content. There is also the interesting and intriguing, if farfetched, possibility of increasing the oil content of pulse crops without any reduction in protein content. Increasing protein content by selection may not be easy, partly because of the lability of this character under

environmental pressures and partly because of unfavorable correlated responses in other agronomic attributes. A selection scheme based on a wide variety of germ plasm should be able to overcome these drawbacks. Another problem has been the nonavailability of suitable techniques to permit rapid screening of the large amount of material that would be involved. In particular, nondestructive techniques, such as NMR spectroscopy, for such estimation in single seeds need to be developed.

The quality of the protein is again of great importance. It is essential in any program of increasing pulse proteins that the amino acid profile not be disturbed in an unfavorable direction. In considering this aspect, the dietary habits of the people must be kept in mind. Where pulses are consumed with cereals and leafy vegetables, maintenance of the present amino acid profile may prove optimal. If any change is needed at all, it may be to increase lysine levels rather than methionine/cystine levels. When the available high-lysine wheats, maizes, barleys, etc., are more commonly used there may not be any need for this either. The fact that the carbon source for four essential amino acids, including methionine, is provided by aspartic acid may mean that an increase in methionine occurs at the cost of other essential amino acids. Careful thought should be given to such correlated responses, so that any genetic change does not adversely affect other beneficial nutritional constituents or increase antinutritional factors such as competitive nonessential amino acids, toxic inhibitors, etc. Constant biological monitoring of nutritional value should therefore form an integral part of all such efforts; the development of reliable and easy screening techniques for such monitoring is of obvious importance.

Since pulses have been fully accepted and used effectively as protein sources, the possibility of introducing toxic factors which are not eliminated in the usual processing appears minimal and of lower priority as long as the material concerned belongs to cultivated species. However, if and when related but differing species are introduced into the breeding program, screening for such factors may

become necessary and adequate monitoring techniques will be needed.

Digestibility is another factor which may need attention. It is said that children, the group at greatest risk, can tolerate properly-cooked legumes well and that the flatulence caused is not sufficient to cause loss of appetite. However, pulses are known to differ in the extent of flatulence they cause; for example, Phaseolus aureus (and probably also Vigna sinensis) causes much less flatulence than other pulses like Phaseolus mungo and Cicer arietinum. There is evidence that the nature of the starch may be different in the Phaseolus species and this may be responsible for the difference in digestibility of these two pulses, rather than differences in the digestibility of protein.

Other factors which may need attention are milling and cooking quality, organoleptic characteristics, etc. Again, however, these will take a lower priority except in programs involving widely different species. The most desirable approach for the present would appear to be to develop suitable conditioning techniques.

Agronomic management and plant protection

Pulses have been traditionally grown as low-input crops and consequently selection has been for genotypes which can withstand such subsistence management. Hopefully, the approaches outlined above would result in genotypes with high innate potential. Such potential will, however, be reflected in the

harvest only if adequate inputs are provided to the pulse crops. It will also be important to protect these harvests from disease and insect pests throughout the cropping period and, particularly in the case of pulses, from storage pests, aflatoxin-producing organisms, etc. In such endeavors thought must be given to lower-cost, ecologically-acceptable control methods to complement methods of chemical control.

Collection, assessment and maintenance of germ plasm •

Coordinated work by a team of specialists in various disciplines such as genetics, breeding, physiology, biochemistry, nutrition, entomology, plant pathology and others is needed to ensure success. The success of the efforts of this team of specialists will depend upon the availability of sufficient agronomic variability. Assembling, maintaining and evaluating as complete a range as possible of the germ plasm in all pulse crops will therefore be a vital necessity. Such a collection of genetic stocks is especially urgently needed in previously unsurveyed areas, especially where these are putative centers of origin or divergence. Even in areas where surveys exist, these have generally been relatively incomplete and more intensive surveys are needed. Uniform systems for recording and retrieving relevant information on the germ plasm collected and practicable systems of maintaining it without genetic drift or loss and making it available as needed would also have to be worked out.

EVALUATION OF FOOD SUPPLEMENTATION AS A NUTRITION ACTION PROGRAM*

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Food supplementation for a population is a long-term community program involving the supply of selected foods to a specified target group of

persons on a regular basis. The food supplements or adds to the usual diet and generally provides nutrients in fixed amounts

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calculated to overcome a deficiency prevailing in the target group.

Food supplementation is only one form of intervention directed toward the prevention and control of malnutrition (1). Some action programs are strictly nutritional, such as nutrient fortification of a staple food or subsidizing or rationing of foods; nonnutritional programs are those such as control of communicable disease, environmental sanitation, health education or income supplementation.

A decision on intervention at a particular time or place is determined by the nature and extent of the problem requiring solution, by comparative cost/benefit calculations of practical alternatives and by the resources available in funds or experienced technical staff. The program chosen will often be multifaceted, employing at the same time two or more types of nutrition intervention or a combination of nutritional and nonnutritional measures.

This article is concerned with the philosophy and principles of a food supplementation program and the methods of evaluating its effect. Many of the principles apply also to nutrition intervention programs other than those supplying food.

Successive steps in program development and application are:

1) Accumulation of knowledge on the extent of nutritional disorders common to the region, their immediate causes and the interrelationships of these causes with other biomedical and social determinants. This information is obtained mainly by field surveys of nutritional states, food consumption and food habits; by laboratory studies; and from the records of official health agencies, the hospitals of the region and nutritional or other treatment centers.

The food consumption and nutrition survey is a comprehensive community investigation, using an appropriate sample selected on a statistical basis. The survey requires planning and organization, collection of data

and data analysis (2).

2) Incorporation of the collected data in plans for an action program integrating existing schemes for national development and combining or enlarging pertinent nonnutritional activities, notably control of infectious diseases and expansion of health education (3).

3) Implementation of the plan.

4) Continuous or periodic assessment of the value of such nutritional programs in achieving fixed goals of better community health.

Justification

The initial phase of program development must ascertain with reasonable accuracy that a particular type of malnutrition is of sufficient frequency to justify intervention, that in severity of effect it is important among nutritional disorders of the region and that it warrants priority in relation to other health problems.

Previous nutritional or related studies in the region or other available evidence can contribute to workable estimates, and may often suggest those groups of the population most affected. Known facts about an adjoining or comparable region may also be of value, especially if profitable results have followed an action program.

Program planning

With the question of need satisfactorily resolved, the next move is to construct a plan for the conduct of the program. This must include provision for the evaluation of its worth, without which no action program is complete. The simplest operational plan first establishes baseline values on the nature and incidence of the identified malnutrition, then prescribes the conditions under which the intervention is to be conducted and finally, stipulates the means of measuring the results.

The key to all planning is again the information acquired in the initial survey stage; the values by which to measure accomplishment are derived from that data. The survey gives an

idea of the nature and extent of administrative and operational problems likely to be encountered and a pilot study provides a test of plan validity. The evaluation is of the plan put into practice, as modified and revised during the pilot study.

Administrative.

Cost/benefit analysis is a highly technical procedure by which the gains to be had from projected food supplementation are weighed individually against those accruing from other nutritional and nonnutritional activities, either under way or under consideration. Investigative studies, such as a field trial of a newly-developed food for the prevention and control of malnutrition, usually pay little attention to cost/benefit relations. Their aim is to determine the worth of the food under optimal investigative conditions.

However, when the findings of a research investigation are transferred to an action program, the cost involved and benefits accrued become critical in comparison with other nutrition promotion activities (4). The practical requirements in food intervention programs can generally be met by assuring that the scope of the program fits the available resources in funds and in staff. The objectives and extent of the program and what it will include can then be specified in an orderly fashion.

Operational.

Fundamentals of this aspect of planning include the decision on the nature of the supplement to be employed and the technical means for program management. Provision is made for a pilot study to test the feasibility and productiveness of the projected scheme and the development of a protocol by which to evaluate results is a built-in part of the plan.

Supplement. The most common nutritional disorder in developing countries is protein-calorie malnutrition; other familiar deficiency diseases include avitaminosis A, goiter and anemia. Each has well-developed methods for prevention and control and these determine how and in what form the intervention will be carried out.

For protein-calorie malnutrition, the usual diet is supplemented with a protein- and calorie-rich mixture, either prepared in the home or centrally processed; the provision for iodine deficiency is fortified salt; and for eliminating a specific deficiency disease, distribution of the appropriate food.

The ages of a target group are likewise more or less decided by the kind of deficiency. Preschool children will be the target in protein-calorie malnutrition, with special emphasis on children, usually four months to three years old, in the course of transition from breast feeding to an adult type of diet. In contrast, iodinated salt and nonfortified staple foods ordinarily are directed to general populations.

Program management. Distribution of the food or nutrient to the target population outranks all other considerations in the success of a program. It must reach the members of the intended age group in the specified amount and with scheduled regularity. The tendency to readjust or modify the target population to suit the delivery system must be strongly curbed.

Preschool feeding programs usually pose difficulties in food distribution, with a choice between the expensive and often poorly-attended central feeding station and home delivery or other methods commonly characterized by lack of assurance that the target child gets the intended food. Most such programs are least effective among children in the first three years of life when the need is greatest. The pilot study should test the various methods of distribution so that a reasonable compromise can be achieved between costs and effectiveness, as well as an equal provision of the food to the age groups most at risk.

Pilot study.

The pilot study has the sole purpose of determining the extent to which the proposed operational plan, as conceived and under the conditions for which it was designed, constitutes a workable means to meet preestablished objectives. This practical test of both operational and evaluation methods

should be distinguished in purpose and procedure from field trials of a new or unconventional food or food product, and also from the nutrition and food consumption survey.

The field trial of a newly-proposed food (5) is a true experiment under controlled conditions with optimal staff and facilities; its purpose is to measure the previously-undetermined capacity of a food substance to bring about a better community nutritional state or other improved health index. The nutritional survey (2), as employed in the initial phase of the present endeavor, aims to identify the nature and frequency of nutritional diseases and allied conditions in the absence of deliberate intervention. The methods used are those of descriptive epidemiology.

A pilot study of an action program offers a means of testing the efficiency and appropriateness of all administrative and technical procedures. The training and experience of staff members contributes to satisfactory performance and the resulting data are the basis for preparation of a protocol by which to judge accomplishment.

Such a study may require no more than four to six months to confirm the choice of procedural detail provided by the study plan. However, individual methods and measurements that prove inadequate must be revised or a substitute sought, a requirement that necessitates repeated tests until an acceptable result is obtained.

Both administrative and technical procedures require quality control for completeness of specified observations, for standardization of methods of measurement and for the capability of individual observers to produce consistent results (6).

Since evaluation assesses a program as eventually put into practice, decisions based on the pilot study in regard to validity of procedures and training of staff are a prerequisite. Until the program takes definitive form, what is to be evaluated remains undetermined. Furthermore, evaluation is based on recording changes in relation to broad aims set down for the particular

program. The protocol for evaluation should include a clear definition of objectives in terms of practical goals or tangible accomplishments, together with the estimated time within which each should become evident. This cannot reasonably be done until enough data have accumulated from the pilot study to make purposeful judgments.

As a consequence of these interrelated considerations, a pilot study usually runs longer than expected or projected. This is not wholly deplorable; the principal aim is to assure that the program has a reasonable chance of working. Even if this is not achieved, the pilot venture has still served the purpose of finding out that fact.

Program conduct.

However extensive its proposed application and despite adequate preparation by pilot study and staff training, the program should start slowly in a limited area; territory can be added gradually until the projected scope is reached. This contributes to the orderly recruitment of added staff and maintenance of operational efficiency. Through comparison of areas in progressively enlarged states of program development, an added measure of progress and achievement is possible.

Evaluation

A protocol for evaluation must be developed as an integral part of general planning for the program. Modifications and revisions deriving from the results of the pilot study are necessarily incorporated in evaluation procedures; the assessment is of the action program as put into practice. The results of the pilot study had also permitted a statement of the precise goals to be logically achieved by individual objectives and the time within which they might be expected to develop.

Evaluation measures.

The characteristics that decide the value of an action program are as follows (7):

- 1) Appropriateness: that within the value system of competent decision-makers, the activity (function, procedure, operation or technique) has recognized standing as a means to accomplish a stated purpose

- 2) Adequacy: that the proposal has demonstrated an ability to reduce in significant degree the presence of a public health liability
- 3) Effectiveness: the ability of an activity to attain preestablished goals
- 4) Efficiency: that the cost in resources (staff, funds, materials, facilities) is commensurate with the benefits attained
- 5) Side effects: all effects other than those prescribed by objectives of the operational plan, whether anticipated or unanticipated, favorable or unfavorable.

The specific objectives of evaluation are those of the action program itself and are conveniently grouped within four principal areas. Some are short-term, others are long-term; some are technical and others administrative.

Administrative and operational efficiency.

The main features within this category are the target group reached, the regularity and consistency of participation, adequacy of the measurements used to determine effect, standardization of observer performance in making such measurements and quality control of collected data. These and other features of cost efficiency should be determinable within the first year of operation of the program. They bear importantly on the degree of success in attaining objectives of recognizably slower evolution.

Impact on community and family dietary habits.

Depending on the nature of the nutritional deficiency and the program instituted, community changes in attitude toward diet and in family practices may be expected within a year or two. The common indicators are changes in food selection, infant feeding and weaning practices, manner of food preparation and distribution at the family level and food production in village and kitchen gardens.

Health response. This will include improvement in the nutritional state of the target population and a lesser morbidity and mortality, overall and for specific infectious and nutritional diseases. It is likely that more than one or two years will be required for significant measurable changes.

Promotion of social and economic development. Social and economic effects of a program, inevitably a long-term response, profit from specific professional assessment. Individual qualities are rarely authenticated except through a comprehensive ecologic evaluation over an appreciable time span.

The means of evaluation.

Three general procedures for assessment of how well a food intervention program has met its stated objectives are listed in increasing order of merit.

Administrative decision. A conviction may exist that the inherent value of the action program is wholly apparent or a demonstrated success in other situations may be accepted as universally applicable. This leads to the often false assumption that the results of a preceding experimental field trial will automatically be duplicated in general wide-scale application.

Opinion survey. Opinions collected by mail questionnaire, by telephone or by personal interview of participants or residents of the area will provide only subjective evidence of a general nature and will lack authority.

Field test. For sound proof, field study has no substitute. The procedure uses inquiry through direct observation, carefully scored and recorded, and whenever possible through actual measurement of the variables encountered.

Field evaluation

Unlike the intervention program itself, which is an open-ended operation with provision to enlist all eligible subjects, the field evaluation process is a strictly analytical procedure conducted on a sampling basis with established controls and an experimental design. The results depend on the choice of a sample which is representative of the whole, on the validity of the tests employed and on what is measured (8).

Data collected.

Measurement is of the degree of change from

the baseline, using progress indicators that reflect the accomplishments under evaluation. These indexes may be clinical signs and symptoms, anthropometric measurements, biochemical tests, response to specific questions posed to the members of the community or target group representatives or actual field observations on specific points related to food production, preparation and consumption.

The protocol of procedure in evaluation originates as a principal function of the pilot study. A close association with the project from its inception by those responsible for the eventual evaluation enables a proper selection and grading of indicators on the basis of specificity in measuring changes. Experience gained in the pilot study is the main means for estimating the feasibility of obtaining data of reasonable accuracy on potential indicators. To a large extent, the choice is also based on the available financial and technical resources.

To be of practical value, the selected indicators should be routinely obtainable, easy to record and interpret, capable of expression in clear terms and specific to the changes in health, nutritional state and food habits the program is attempting to promote. Since infants, children and pregnant and nursing women usually constitute the nutritionally-vulnerable groups in the population, indexes should be specifically those that will assess their food habits and nutritional status. In the case of clinical indicators, it is necessary to define them precisely and to identify acceptable standards or criteria for their measurement. The methods of measurement and the manner of expression of results should be explained clearly to assure statistical reliability and valid interpretation.

Observations and recording of data on items specified in the evaluation plan should continue throughout the period of assessment. Any necessary or desirable additions or modifications of method should be described fully, including the date instituted, and entered as appendixes to the evaluation protocol.

Test population.

In size and representativeness, the pilot population sample upon which planning was originally based may continue to answer all requirements for program evaluation. Adjustments in the course of planning, however, often bring changes in the numbers of persons and the area involved. The adequacy of the sample for evaluation must be re-examined to assure that social differences among rural populations are covered and that the poorer fringe areas and central sections of large metropolitan regions are represented. Sample size is determined statistically on the basis of frequency of nutritional disorders and other variables such as morbidity and mortality from infectious diseases.

Assessment of definitive result.

A prospective cohort analysis, namely the study of the same group of subjects initially and on all subsequent occasions, is the simplest experimental design for evaluation of the inherent accomplishments of action programs which use a known or established food. Baseline values are set by appropriate survey of the test population as finally established. The program goes into action simultaneously in the test area and in the general region according to the perfected plan, in both instances under the auspices of an operational staff as prescribed by the study plan. A specialized staff to serve the test population and another of lesser capacity for the general program to be evaluated defeats the purpose of evaluation, which is to assess the proficiency of the program as projected and conducted.

After a suitable time, usually one year to allow for seasonal variations, a second survey is made, the results compared and the progress measured. An evaluation describes the situation at the time it is made; it does not necessarily hold for the future under potentially altered conditions of environment or program performance and reevaluation at annual intervals is good practice. Initial and subsequent surveys follow the same schedule, using either the original methods or properly-

identified variations and additions. By using an accepted standard, the results may be judged in relation to other comparable regions.

Within recognized limitations, simple comparison of prevalence data (9) derived through survey of selected indicators serves adequately to express progress and achievement. However, the occasional occurrence of events in the test population not directly related to food intake may make the area nonrepresentative of nutritional state for the program area as a whole. These include such natural catastrophes as flood, drought or epidemics, or a local economic stringency. Conversely, their occurrence in some part of the program area and not in the test area may discount the evaluation findings as truly representative.

The population of the test area is usually so small that expressing deaths as a feature of the nutritional state has no statistical significance. Knowledge of fatalities from the entire program area, in themselves a good index, is necessary for the expression of many causes of death specifically related to nutrition and infection.

Program costs are likely to be greater in the test area because of expenses incident to evaluation. They vary from one region to another because of differences in food delivery practices. The more reliable value is from total expenditures.

Finally, evaluation at its best monitors results as they are attained, its principal functions being to identify shortcomings in program procedure and to effect remedial measures. Delaying evaluation until the time of resurvey is costly and may unnecessarily impede achievement of possible goals.

For these reasons, especially that just stated, evaluation includes a second procedure, that of surveillance.

Disease surveillance.

Surveillance of a disease is the continuing scrutiny of all aspects of frequency and distribution that pertain to effective prevention and control. Through greater comprehensive-

ness than facts derived solely through formal survey of selected indicators, surveillance data help in the proper interpretation of results. They make the evaluation process more reliable and, most importantly, permit prompt refinement of technical methods and administrative conduct of the program. The procedure applies to the whole of the program area, including the test population.

The content of information obtained by surveillance follows no fixed formula. It includes a variety of events and circumstances, nutritional and nonnutritional, presumably affecting the stated objectives. Some observations are quantitative and specific; others rest on the opinion of the observer or others. Adequate surveillance is facilitated by the standard epidemiologic procedure of the field notebook, recording chance or planned observations, day by day, with an appropriate summary of the more cogent findings at weekly intervals.

Included are recorded activities of institutions dealing with disabilities of the target population and interviews with the responsible officials; a review of activities in nutritional and public health education and their reception by the general public and target population; and the effect of holidays, social disturbances and such physical catastrophes as floods and fires on program acceptance. Surveillance of the target population is carried out with special reference to changes in socioeconomic conditions, food consumption trends, the occurrence of epidemics or any other striking alterations in the mode of life.

Discussions with local health officials and review and tabulation of locally-available records of public health or other administrative agencies will be useful, especially with regard to information on births and deaths and causes of death. This information may require spot checks to verify its accuracy and to obtain details. In spite of recognized deficiencies, these vital statistics serve a useful purpose as progress indicators. The most useful are infant mortality rates; death rates among children of preschool age; specific death rates from malnutrition and certain infectious

diseases such as measles, diarrhea and whooping cough; ratio of deaths of preschool-age children to total deaths; and ratio of deaths of preschool children, especially in the second year of life, to deaths of infants under one year.

The local health centers and the hospitals that serve the area will help greatly in providing information on some of these points. Some of the above items of information can also be obtained from small typical samples of families from among the target population.

In summary, the evaluation of a public service or action program in nutrition is primarily a responsibility of the staff, administrative and technical, conducting the operations; surveillance is a direct affair of local field workers. The more formal periodic surveys of progress in the test area are a staff function, with added members for a particular task if necessary and help from outside technical experts if laboratory or other measures are included for which facilities or experience are not at hand. The appraisal of long-term social progress and economic development ordinarily calls for specialists, but not to the exclusion of the local staff.

As to how long evaluation lasts, the best advice is that it never ends as long as the program continues. Continued watchfulness is a necessity since few programs run themselves.

Some evaluation activities

An evaluation may emphasize administrative and operational procedure or health values and may be short-term or long-term. The problems encountered generally fall under the following categories:

Intervention with a proven food.

This is a program initiated in a new locality, based on a food that has had extensive use in other regions with a demonstrated capacity to produce favorable nutritional results. The research has been done and experience acquired in practical application. To initiate a program in a new region involves mainly a demonstrated need, sound administrative control and a well-ordered and periodic appraisal of benefits (10).

Evaluation of an ongoing intervention program.

Provision for evaluation as an integral part of a proposed intervention program has been established as a principle. Nevertheless, too many programs are instituted with no planned evaluation and are conducted without any. This does not preclude an assessment of the accomplishments of an ongoing program, provided the limitations are understood. If comprehensive baseline values have been established, the neglected evaluation may be instituted after a period of time. If no baseline exists, those values may be obtained and evaluation then instituted, again with the recognition that the progress demonstrated is partial, relative to conditions at the time the evaluation was instituted and not to the original situation. A delayed evaluation is better than no evaluation at all.

Effects of multiple or multifaceted programs.

Food intervention programs often incorporate other preventive and control measures against infectious disease and combine public health education, including nutrition education, with maternal and child health services, all of which act favorably on the nutritional and dietary situation (3). Several other programs may be in operation independently, and these may have effects on the health, nutrition and food habits of the population. Hence, evaluation of a food intervention program should take into account the effects of these other activities.

Newly-developed, untried food supplement. Favorable conditions in the local area may have led to its choice as the site of an action program for the first application of a novel food for wide-scale use (5). After proper testing in animals, the product has been field-tested on human subjects earlier and the results have been found favorable for extension as a limited action program. Community application is still a pilot endeavor and evaluation should be careful, continuous and intensive. Quality control of data and standardization of measurements are essential procedures to be undertaken as evaluation proceeds.

Operational research in evaluation.

Any action program gives the opportunity for operational research toward improving evaluation methods. It may lead to better methods for identifying a particular nutrient deficiency, to improved procedures for food distribution and supply or to more effective community nutrition education.

Uses and applications of program evaluation

The uses to which the evaluation data can be put depend upon the nature of the intervention, how intensively the evaluation is pursued and whether operational research is included among the objectives (1).

Uses.

The authority responsible for the project must be satisfied that the action taken reasonably fulfills the measured needs of the community for better nutritional status (11). The administrator should be able to weigh the benefits accrued against the gains from other activities toward nutritional improvement, notably decreased general morbidity and mortality, and to determine that costs are commensurate with the gains attained. The development planner has a means of comparing the relative contribution of a nutrition intervention with other activities directed towards social and economic progress and the nutritional investigator adds a source of information which differs from cause-and-effect studies. Proper evaluation especially favors improvement of the means of measurement of malnutrition itself and of the other multiple elements contributing to it (12).

Application.

Program evaluation demonstrates how closely the observed results approximate the goals of accomplishment, set in advance, for variables directly and indirectly contributing to improved nutritional state. It compares the attained results with achievement in comparable and other regions and it identifies administrative and technical parts of the program that account for failure to reach a defined goal.

Evaluation also measures the capacity of food intervention alone to remedy existing

community malnutrition and the extent to which action requires enlargement through other appropriate health measures in the form of an applied nutrition program (13). Such measures include control of infection, maternal and child health care, environmental sanitation, public health and nutrition education and social and economic betterment.

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FOOD PATTERNS AND FOOD HABITS IN INDONESIA

by S. Soemardjan*, Secretary to the Vice-President of Indonesia,

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The National Institute of Economic and Social Research in Jakarta, sponsored by the Ministry of Health, UNICEF, WHO and FAO, conducted a study in 1969 of five rural villages in Indonesia with regard to the social and cultural aspects of food patterns and food habits of the population. The study was multi-disciplinary in that the research and consulting personnel were drawn from a variety of academic disciplines.

All five villages show a strong traditional social structure with traditional and religious leaders playing an important role in the village community. The culture of the villages in West Java (Islam) and Bali (Hindu) is clearly dominated by religion. However, whatever the differences between the villages, there is a distinct internal homogeneity in each individual village as evidenced by a conformity in the food patterns and food habits of each household. Rice and meat are considered high-status food items, consumed usually by wealthy people or occasionally in unmixed form by the ordinary population. In many instances it is not only financial barriers, but also the sense of being low-class that prevent ordinary people from including white rice and meat in their daily

menu. Fortunately, in the villages on Java, tempe, oncom and tahu, three varieties of soybean cakes, are popularly used as side dishes to the principal meals and thus add to the vegetable protein intake of the people.

The study has revealed a remarkably strong desire in all five villages for freshwater ponds for fish cultivation, but local water shortages, except in West Java, do not allow for the easy transfer of this desire into reality.

Contrary to observations elsewhere, children in the five villages under study are not a deprived group, because of the parents' willingness to sacrifice in favor of their children's food. Children of two years and older, however, eat the same food as adults, and hence improvement of the children's diet can be brought about only by changing the diet of adults. Because of the prevalent poverty situation, food is considered more as a means to quiet hunger than a means to good health.

On the basis of the major findings of the study, a number of recommendations are suggested in the framework of a national applied nutrition program. A well-planned nutrition program is

* Member of PAG.

imperative in view of poor nutrition conditions in the rural areas, particularly in the densely-populated areas of Java and Bali. Considering the low level of education of the population, it is recommended that traditional forms of visual, dramatic and theatrical presentation of nutrition messages be employed, supplemented by person-to-person communication by extension workers. The significance of traditional and religious leaders as potential agents of innovation should not be ignored.

Nutrition deficiency in the villages under study is more a function of economic poverty than of

food scarcity only. An applied nutrition program therefore will meet only failure if it is not firmly supported by a successful overall economic development program, which should give the highest priority to food production as a first step. Ritual meals at religious and other ceremonies should not be considered wasteful, as many economists think, but should be evaluated for their function as a source of protein supply. In conclusion, it is recommended that we capitalize on the great concern of parents for the food of their children in order to initiate nutritional improvements in the children's and adults' diets.

BREAST FEEDING AND WEANING PRACTICES IN DEVELOPING COUNTRIES AND FACTORS INFLUENCING THEM*

Weaning refers to the replacement of breast feeding by liquid foods, including milk, or semisolid or solid foods, administered by a feeding bottle or with a spoon from a cup or plate. The replacement may be abrupt or gradual, lasting from several days to a few months. In preparing this review on breast feeding and weaning practices and factors influencing them, information has been drawn freely from available recent literature and from the earlier statements and recommendations of the PAG itself on the subject.

The traditional feeding of young infants, i. e. infants below six months of age, in all parts of the world and particularly in the developing countries, has always depended on the availability of a sufficient supply of human breast milk. The progressive decline in breast feeding in the industrialized countries was made possible by modern developments in dairying and food technology. These have resulted in widely-available supplies of processed milk-based products suitable for feeding young children and within the financial capabilities of the families. Artificial feeding from early

life became possible and successful in these countries because of availability and economic capacity to buy, the prevailing good standards of environmental sanitation and hygiene, adequate running water supply, availability of procedures for sterilization and storage and a good understanding of these by the mothers and their ability to read and follow the instructions on the label. However, it is doubtful whether artificial feeding during early infancy will ever be able to provide the psychological and emotional advantages of the mother-infant relationship to the same extent which unrestricted breast feeding is considered to offer both participants.

In most communities in developing areas of the world even minimum facilities for bottle feeding are not available. Indeed, the circumstances are such today that the populations in many communities cannot offer artificial foods to their young infants without serious danger to their health. Unfortunately, however, a decline in breast feeding and shortening of the duration of lactation with haphazard artificial feeding has spread rapidly during the last few decades among

* Prepared by the PAG Secretariat. Paper presented at the PAG-sponsored Pediatrician/Infant Food Industry Seminar, held in New York on 11 June 1973.

these populations, resulting in serious health consequences for the infant.

Practices

There are many small-scale studies reported in the literature on breast feeding and weaning practices among communities in developing countries of the world. The essential findings of some of these surveys are mentioned briefly in the following paragraphs.

Asia: The majority of low-income-group infants in rural and semiurban areas in certain parts of southern India were reported to be exclusively breast fed until six months of age (1,2). The total duration of breast feeding was found to be prolonged usually well into the second year. Among urban low-income groups in western India, it was found that mothers breast fed their infants for six months to a year and regular supplements were started after one year of age (3). In communities near Delhi, it was reported that 37% urban, 5% semiurban and 2% of rural mothers wean their infants by the age of one year (4).

A comparison of breast feeding practices from welfare clinic records among Malay, Chinese and Indian women resident in Kuala Lumpur, Malaysia, for the years 1960-65 revealed that among the Chinese and Indian women the incidence of breast feeding was showing a declining trend, with lower incidence and shorter duration than in Malaysian women (5). The trend was more clear-cut among the higher-income group. The better record among Malay women is believed to be due not to ethnic differences but to limited contact with other people, since most of them do not take up outside employment.

A study in Singapore reports that the number of Chinese mothers among higher-income groups who discontinued breast milk feeding beyond three months of age of the infant was 52% and 92% in 1951 and 1961, respectively. Corresponding figures for the low-income

group were 29% and 58% (6).

In some rural areas of the Philippines nearly 75% of the mothers were found to breast feed their infants exclusively until six months of age, 20% offered a mixed diet and nearly 5% provided bottle feeding. The mean age of weaning for those receiving mother's milk was about fifteen months (7). In another study in an urban area, the duration of breast feeding for the majority was stated to be nine to ten months (8).

Africa: In a report on breast feeding habits in relation to culture in Ethiopia, it was stated that in a traditional community in the northern part of the country, mother's milk was the exclusive food of infants and young children for prolonged periods and the mothers treated with suspicion any change introduced from outside (9). In affluent communities, frequent outside contact from market trading of cash crops enabled easy acceptance of changes in infant feeding; mother's milk was supplemented with artificial feeding at two or three months after birth. In a cattle-raising area, the trend was intermediate and infants were breast fed for about seven to twelve months.

In Senegal, most babies were breast fed for a considerable length of time and the average weaning age was reported to be about two years (10). In the Tabora region of Tanzania, breast feeding up to one year was the natural thing and was observed in 96% of the mothers (11).

Adequate and satisfactory breast feeding of infants during the early months of life was observed in 100% of rural mothers living outside Ibadan, Nigeria (12). Among the low- and high-income groups in the city area, the figure was 55% and 12%, respectively. In families of the academic staff at the university campus, the percentage was less than one. For comparison, the author quotes results of studies in the same area two decades ago when the incidence of breast feeding was 100% for all women. In a recent study in the same locality, it is reported that breast feeding in

Ibadan has declined dramatically as the exclusive method of feeding infants (13)*. Mixed feeding is usually started at less than three months of age and solids are introduced while the breast feeding continues and the bottle is dropped.

Middle East: Nearly two-thirds of low-income Lebanese mothers in urban and periurban areas are reported to feed their infants on breast milk for at least six months (14). However, those fed exclusively on breast milk were only 15% of this number. A report from Alexandria, Egypt, states that most infants in this setting were weaned between two and four months of age (15).

Latin America and the Caribbean: A report on "Patterns of mortality in childhood" (16) reviews breast feeding practices and their relationship to mortality in twenty-three widely-separated areas of Latin America. Based on the findings of the survey, the report concludes that the increasing use of hospitals for delivery of babies has probably resulted in an increase in artificial feeding. Also, advertisements for milk substitutes and the intensive publicity given them in various sectors of the population have probably had unfavorable influences.

An investigation carried out in a village with a population of 6,000 sixty-five miles southwest of Mexico City showed that nearly 61% of infants were fully breast fed at the end of three months but only 9% of these continued with this practice until the end of six months. This finding is considered dramatic in the light of the results of a previous study in the same village published ten years before, which reported that 91% of infants were fully breast fed at the end of six months. Nearly twenty food items reported as being introduced in the infants' diet after six months were found to be given before the age of four months (17).

Breast feeding and weaning practices in rural villages of Central America showed great differences in different countries due to variations in social, economic and cultural

conditions (18). The duration of lactation was shortest in Costa Rica where nearly 40% of the infants had been weaned at four months of age. In Guatemala and Honduras, breast feeding was prolonged and extended into the second year. The trend in Nicaragua and El Salvador was intermediate; in the latter country 22% of the infants were weaned at six months and 55% by the end of one year.

In urban and rural Chile, nearly 16% of the mothers were found never to have breast fed their infants and about 80% to have stopped breast feeding after two months (19, 20).

A longitudinal follow-up of mothers and their infants from birth in Jamaica (21) showed that combined feeding was most popular between six weeks and five months of age. Bottle feeding was frequent after three months. Studies carried out in other islands of the English-speaking Caribbean have shown that 4% to 25% among the low economic groups bottle feed their babies within one week; the figure for the middle-income group was over 50% (22, 23). The practice of breast feeding was found to be diminishing rapidly among Trinidadians and 74% and 42% of mothers of East Indian and Negro origin, respectively, bottle fed their infants from birth (24).

The outstanding facts emerging from this brief summary are:

- 1) There is a wide variation between one country and another and between areas in the same country with regard to the incidence of breast feeding. However, the trend shows a distinct decline in all areas, the rate of decline varying from place to place.
- 2) The results are generally based on one-time studies and the procedures adopted are not uniform. The presentation of results also varies in different studies. This makes it difficult to evaluate the trend in a community, say during the last five or ten years, or to compare information available in one area with that from another.

*The report of this recent study is summarized briefly on page 32.

3) In general, the rural areas and lower economic groups seem to favor breast feeding more than their urban and well-to-do counterparts. However, there is a trend toward a slow, or sometimes rapid, changeover to artificial feeding earlier in infancy and among larger number of mothers in both the rural and urban areas, particularly in the low-income urban groups.

4) Any differences between ethnic, cultural, class or language groups in a particular area seem to depend upon the degree of sophistication and outside contacts which the group has had and not on any other factor.

5) In most of the surveys there is insufficient recorded information regarding the type of infant food given and the manner of feeding it.

6) Information is also inadequate on the specific cause or causes operating in the different areas and communities and the nature and extent of their interplay in influencing breast-feeding habits.

Since the picture is constantly changing, information will always be incomplete with regard to the social dynamics of breast feeding and weaning practices and the factors influencing trends.

Factors in the declining incidence of breast feeding in developing countries

The declining trend in breast feeding seems to be the result of complex, multiple, inter-related factors. It would appear to be a group maternal (or community) response to sustained bombardment by a variety of external influences on the sensory systems, aided and abetted by concurrent economic and social changes. These external influences slowly but surely alter the emotion and behavior, the thinking and the outlook of the mothers, leading to stoppage of breast feeding. Failure to breast feed is not due to any biological incapacity but is the result of a weakened motivation.

The main factors responsible for the decline may be considered as three overlapping causes: sociocultural changes, the effect of

health services and the influence of commercial persuasion. The PAG ad hoc Working Group on Feeding the Preschool Child has discussed these factors and what follows is largely extracted from a PAG document (20).

Sociocultural change. In developing countries, high-income groups are usually the first to adopt artificial feeding. The urban life-style is characterized by a move towards a money economy and foods that are purchased; towards a small family rather than an extended unit; and towards a different role for women, who may be expected to work away from the home for wages and who become less concerned with child rearing. There is a tendency to adopt certain practices, such as bottle feeding, which appear to symbolize a trend as exemplified by the educated, well-to-do elite. In urban circumstances, the Western attitudes of anxiety over breast feeding being a cause of losing one's figure and the discouragement of breast feeding at work are important factors.

Effect of health services. Health workers, including general medical practitioners, pediatricians and obstetricians, nurses and midwives, have had a tremendous impact on the declining incidence of breast feeding, especially in the developing countries.

On the whole, the training of health workers of various categories, including medical students, emphasizes the importance of artificial feeding and takes little interest in breast feeding. Prenatal care which is deficient in health education, hospital routines and regulations in newborn nurseries and during the postpartum period and the rapid turnover of maternity cases all tend to discourage breast feeding. Conflicting advice is often offered; when mothers attend a prenatal clinic, great emphasis is placed on breast milk but when the baby is born, the mother and baby are separated and formula feeding is encouraged. Health services are often the channels through which infant foods and other special foods of one sort or another flow. In some cases the food supplements issued, especially milk powder, have had the side effect of acting as "breast-milk displacers",

given with the tacit endorsement of the health services.

Availability of artificial milk, commercial pressure and simplicity of bottle feeding.

With the advancement of scientific knowledge, important changes have been introduced which have radically modified concepts regarding the artificial feeding of infants and lowered the prestige of human milk. The new technology has simplified the mechanics of infant feeding and formula preparation, has minimized the ill effects of artificial feeding and has filled the stores with a wide variety of canned milk products and baby foods.

During the last two decades the increased availability and consumption of expensive proprietary infant foods within developing countries, stimulated by commercial firms and in many countries also by the nature, variety and scale of advertising campaigns which they have implemented, have had their influence on the breast-feeding habits of the population. Products which are advertised in this fashion are appealing to the mother, who sooner or later displaces her infant from the breast and opts for bottle feeding which may lead to serious consequences. It should be understood clearly that the product is rarely at fault; under the conditions existing in her community the mother cannot use the product effectively and may frequently cause the ill health or death of the infant.

Preventive action against failure to breast feed

The trend away from breast feeding will become increasingly grave with rapid urbanization, without the essential employment and income, social services, environmental hygiene, good water supply, etc., which are prerequisites for an urban life-style of infant feeding as practiced in the technologically-developed countries. Programs must be devised immediately to halt this trend and to prevent its spread to unaffected areas, hopefully permitting the parallel development of industrialization, urban employment and economic improvement. Equally urgent is the need to monitor information on infant feeding, to understand the factors influencing it and to

determine future trends. In most instances, the factors discussed above operate synergistically because of the complex interplay of social pressures and they require careful study and analysis. Logical preventive programs, including appropriate cultural, social and economic motivations, can be based only on the results of such surveys.

While there is a need to devise appropriate studies to investigate the social dynamics of breast feeding, no delay is necessary in implementing programs to eliminate avoidable factors which discourage breast feeding. Several approaches available for this have been discussed in PAG Statement No. 23 (25).

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BREAST FEEDING IN NORWAY^{*}

The promotion of breast feeding and the full utilization of the potential of human milk production on a global scale is an active issue on FFHC/AD's agenda and they have asked other national FFHC committees for comments.

Ms. Helsing calls 'attention to the fact that in Norway there has been a levelling off of the decline, and even an upward trend, in the rate of breast feeding in the last five years. This may be due in a large part to a very simple, and cheap, campaign to promote breast feeding that has been going on for the last five years. This campaign has had three main forms of activity:

- 1) Spreading factual knowledge about how to solve breast-feeding problems, aimed at mothers-to-be and mothers with small babies
- 2) Emotional support to mothers who want to breast feed, through a private organization comparable to 'La Leche League International'
- 3) A simultaneous effort to make sure that breast feeding becomes 'the in thing' through various more subtle means. This organization does not see any contradiction between the liberation of women and the voluntary ful-

fillment of women's biological role".

The results of observations made in two MCH stations in Central Oslo are as follows:

PER CENT WHOLLY OR PARTIALLY
BREAST - FED BABIES
(total no. ~500 in both centers)

		1968	1969	1970	1971	1972
Sagene	2-3 months	29	30	28	33	36
	3-4 months	21	21	20	26	27
	4-5 months	10	10	10	15	19
Christies Gate	2-3 months	28	39	41	36	39
	3-4 months	18	23	28	25	27
	4-5 months	8	9	13	11	12

These figures are considered to be representative of the situation in the urban lower-middle class.

It is considered "important that the initiative comes from the mothers themselves, although a positive and supporting attitude from the health authorities is essential".

Saltsjöbaden, Sweden

SYMPOSIUM AND WORKSHOP ON EARLY MALNUTRITION AND MENTAL DEVELOPMENT

The symposium, held on 20-24 August 1973, was organized by the Swedish Nutrition Foundation in cooperation with the Swedish International Development Authority (SIDA), the U.S. National Institute of Child Health and Development (NICHD) and the World

Health Organization (WHO). The two-day workshop following the symposium was organized by WHO. About forty research workers took part. Contributions to the conference (symposium and workshop) will be published in full during 1974 as Volume XII

^{*} From a letter from Elizabeth Helsing, the Norwegian Freedom from Hunger Campaign/Action for Development (FFHC/AD), September 17, 1973.

in the series "Symposia of the Swedish Nutrition Foundation". The following is a brief summary of important points.

Epidemiological studies of the prevalence and causes of mental retardation in industrialized countries indicate that about 75%, representing mild-moderate forms of retardation, are closely linked to low social class whereas the remaining 25%, representing more severe cases, have an even distribution among social classes. This implies that in the former group unfavorable environmental factors such as poor prenatal, delivery and postpartum care, play an important role. It is understandable, therefore, that in the developing countries the prevailing much more serious environmental deprivation could have similar effects and on a wider scale.

As a background for the main discussion some introductory presentations provided new observations from studies on animals. Abnormalities in the peripheral nerves (delayed development of thick nerve fibers and increased permeability of nerve sheaths to tracer substances), which remained after nutrition rehabilitation, were noted in rats. No changes in the ganglioside content of the brain (normal "synapse density") were found in malnutrition, but it was noted that further studies on the pattern of maturation of myelin lipids are warranted. Data were presented from studies on humans which indicated, especially in kwashiorkor, widening of the lateral ventricles and moderate increase in the subarachnoidal fluid in the acute stage of the disease.

The critical periods in the development of the human fetus and young child were discussed. The thesis was reiterated that, although the neurons have finished multiplying, though not finished growing or developing dendrites, at around twenty weeks in fetal development, the same is not true for the total number of brain cells, including the oligodendroglia, until 1 1/2 to 2 years of age.

The application of conclusions from one species to another must be made with great caution; it is rewarding that studies on

primates are now in progress in several places. In this group also, early severe malnutrition causes marked deterioration in the ability to cope with given test situations. It remains to be seen how nutrition rehabilitation will influence these changes. Further, from experience in rats, it was noted that "pure malnutrition" is never "pure", since it inevitably at the same time interferes with the normal mother-baby interaction.

New observations were presented to the effect that the "culture of poverty", with the combined effects of malnutrition, infection, understimulation, etc., afflicting the child early in life, will give lasting negative effects on mental function as witnessed in a number of specialized tests.

If early severe malnutrition and/or unfavorable environmental influences of other kinds hamper the healthy development of the child, both physically and mentally, then it must be expected that preventive measures would exert a favorable effect. This indeed seems to be true in one longitudinal study. The difference between a control group and a group of children whose mothers got food supplements during pregnancy and the children later cared for by food supplements and other means, was striking, both with respect to physical development and mental performance.

The same positive results were not obtained in another study. A correlation between nutritional status and verbal skills was observed in the first few years of life, but at 5-7 years no differences could be noted. It remains to be clarified whether the selection of controls and the time of starting food supplementation can explain apparent discrepancies.

A different kind of approach and study, as to whether a program with several combined interventions (food supplementation, stimulation, etc.) at ages 3-5 years may still improve school performance and diminish school absenteeism has been undertaken. The results are still very preliminary.

B. Vahlquist

INFANT FEEDING AND HEALTH IN IBADAN^{*}

This project was carried out in the summer of 1972 in Western State, Nigeria, in cooperation with the Nutrition Service of the Federal Ministry of Health, Nigeria. The project involved a survey of 500 mothers with children under four years of age, twenty depth interviews, field studies of health and welfare services and food distribution and study and analysis of data from the Food Science and Applied Nutrition Unit of the University of Ibadan.

Half of the report is devoted to a brief description of the life and people in Ibadan City and its environs. Information is included on people's livelihood, housing, family structure and characteristics, food habits, distribution and marketing, current food prices, data on child health such as birth rate, mortality, health services and facilities, attitude to health services and community welfare programs.

The section on infant feeding briefly reviews the results of three previous studies: Nigerian Nutrition Survey covering the whole country, 1965; the Lagos survey in 1968; and the study in Ibadan conducted in 1970 by the University of Ibadan. The present survey showed that a combination of breast and bottle feeding (including the cup-and-spoon method) was the pattern adopted by 75% of Ibadan mothers while 25% were exclusively feeding the infants at breast. The normal progression was from exclusive breast feeding to bottle and breast feeding at about three months and then to solids around twelve months when breast feeding continues for another six to eight months but the bottle is dropped. Educated mothers and those living in affluent areas were more likely to supplement breast feeding with the bottle. Muslim mothers were more likely to breast feed exclusively than Christian mothers. Working mothers were more likely to opt for breast feeding (77%)

than nonworking women (69%), a situation different from that which would be anticipated.

Mothers who combined breast and bottle feeding stated that they have been advised to do so by the medical personnel, mainly midwives and nurses. Milk company representatives who give talks on feeding are identified with hospital and clinic staff. A strong belief has grown up in the community and among mothers that artificial milk increases the baby's strength and development, to the extent that these foods are often regarded as a "proper baby food" to the detriment of breast milk. The most important reason given by those who did not bottle feed was lack of financial resources. Nonmilk supplementary foods are available ready-prepared from market stalls and traders and mothers are able to buy cooked food throughout the day.

The hygienic practices observed in infant feeding, the types and brands of milk food used and the pattern of usage are described and it is concluded that the amount of artificial food given is always totally inadequate and the preparation and feeding frequently unhygienic. Mothers were found to use about a third of the recommended amount per feed with enormously wide variations. Following an account of the social, economic, nutritional and infectious factors in the causation of childhood malnutrition, the report makes detailed recommendations on health policies for better infant care and nutrition under three categories: education of parents, efficient marketing of natural foods and introduction of new protein-rich foods. Under educational efforts it is stated that mothers are confused on all aspects of breast feeding, bottle feeding and weaning and the need to provide them the right message and guidance is stressed. It is strongly recommended that milk-company

^{*} A summary of a report of this title prepared for the Freedom from Hunger Campaign, United Kingdom Committee, by Social Policy Research Ltd., 1 & 2 Berners St., London W1P 3AG, England. September 1973, 107 pp. The report was made available to the PAG by Mr. Stanley Orwell, Director of Social Policy Research.

representatives be banned from hospitals so that mothers are taught only what is in their own interest. Regarding protein-rich foods, the report doubts the advisability of launching a packaged weaning food in Ibadan both for

social and economic reasons but recommends fortification of yam flour and possibly gari produced in large plants with some natural protein-rich food material.

A. Berg (with R. J. Muscat) :

THE NUTRITION FACTOR : ITS ROLE IN NATIONAL DEVELOPMENT

This publication contains excellent information on the main aspects of the food and nutritional problems of the world, particularly as they exist in developing countries; it offers a systematic and comprehensive view of the role of nutrition in economic development; and it tackles successfully the difficult question of nutrition planning in developing countries.

The book, which is the outcome of the author's first-hand experience in nutrition programming and of extensive studies, consists of twelve chapters and several appendixes. The first four chapters deal with the malnutrition problem and the connection between malnutrition, population increase and economic development; the following eight chapters and appendixes are devoted to various important possibilities for achieving major nutritional improvements and to nutrition planning.

At first glance, some facts appear surprising. One of them is that Berg, in general, does not distinguish between undernourishment and malnutrition. Although the term "protein-calorie malnutrition" appears occasionally in the text, he usually confines himself to the use of the word malnutrition. In this context, it is sometimes not quite clear whether he has only the qualitative aspect of food intake in mind or the quantitative aspect and the energy problems as well. As we are apparently in a period where discussion of the world food and nutrition situation, after so many years of concentration on the protein problem, is swinging strongly to the other side, namely to focusing on calorie supply, such a concept has perhaps a provocative note. Some critics will probably argue that in

this way the specific strategic aspects of the fight against hunger on the one hand and malnutrition on the other are veiled. But as Berg's main concern is the undersupply of protein, vitamins and minerals to the large masses of populations of developing countries, to us the approach seems all the more appropriate, because it permits reducing the argument to some major lines.

Another remarkable characteristic of the book is the renunciation of giving quantitative data on the nutritional situation in the world. This, however, is fully justified in view of the availability of a large number of other publications of international and national agencies or individual scientists which discuss this matter extensively.

In the first part of the book Chapter Two is especially important. It deals with the inter-relationship between malnutrition and economic development. Berg's thesis is that "nutrition is not the centerpiece of development, but it is an important part and is deserving of more attention than it has received" (p. 5). He demonstrates systematically the various economic aspects of malnutrition and shows the principles of a calculation of the costs of malnutrition and of the benefits of its abolishment. It becomes clear that the chances for a thorough quantitative benefit-cost analysis are limited, but certainly no more so than in several other fields of evaluation of development efforts.

In the following chapter, the interrelationship between the nutritional status of a society and the population development is studied. The author does not disavow the dilemma that an

improvement in child nutrition, in the short run, may lead to a higher rate of population increase. But he is hopeful that, over the longer term, the diminishing child mortality will lead to lower birth rates. In the fourth chapter, an important argument is that economic growth does not automatically alleviate the poor nutritional situation of the vulnerable groups, and it is concluded that, in many countries, a mass improvement of the nutritional situation can be expected only if the governments take action for the redistribution of incomes as well.

From Chapter Five onwards, Berg reviews critically the prospects and problems in several important fields of action, such as crop and animal production, nutrition education, infant feeding, unconventional protein foods and public feeding programs. In connection with the discussion on the Green Revolution he stresses the need for more concern by plant breeders for the nutritional quality of new varieties. His view on the potential impact of production of animal protein in poor countries is remarkably reserved. He also makes clear that, so far, nutrition education has not brought about a major breakthrough in the eradication of malnutrition and suggests that new concepts have to be tried. An interdisciplinary approach to nutrition education, so often called for and so rarely realized, and increased use of mass communications media are proposed as promising vehicles to achieve a higher efficiency of this instrument.

A major reason for the poor nutritional status of children is seen in the "dramatic decline" in breast feeding, especially in rapidly-growing urban areas. Berg discusses at some length the background of the phenomenon and possible action to halt the undesirable trend. It turns out that a solution can be found only in connection with more efficient nutrition education programs.

In a chapter on the new foods, the author gives his views on the chances and problems of fortification of conventional food products and of formulated protein foods. His attitude is especially positive towards the future of fortification programs, although, up to now,

very little large-scale success can be reported: "In many ways, fortification is the most attractive of all the complementary alternatives considered in this study" (p. 196). The low-cost foods from non-conventional sources which have received so much public attention in the recent past are discussed in a concise but well-balanced manner. The author has succeeded in furnishing comprehensive information on major aspects of the production of the basic ingredients, physiological and economic problems of the formulation of the foods and on their comparative advantages. Perhaps marketing problems could have been discussed a little more fully, as they are often decisive for success or failure.

Another especially valuable chapter is that on feeding programs for children; benefits, costs and prospects of such programs are carefully studied. Berg concludes that the frequent failures of feeding programs "may lie not in the concept but in their implementation" (p. 171).

The remaining parts of the book deal with various important aspects of the nutrition problem. Again Berg's experience in the planning and administration of nutritional programs and his thorough knowledge of the literature enable him to come forward with valuable insights, for instance when he hints at the need for better cooperation in the field of nutrition between private industries and governments, or when he points out lessons from the Indian approach to combat hunger and malnutrition during and after the famines of the mid-sixties.

In the twelfth and the last chapter, Berg arrives at some general conclusions. After a careful reconsideration of achievements, bottlenecks and important opportunities, he requests "a new scale of concern about the problem and a concomitant new scale of action" (p. 210). Among his proposals are the need for comprehensive and systematic nutritional analysis and planning, for an administrative reorganization and the call for a new academic discipline, leading to a nutrition programmer who is capable of converting the scientific findings into large-

scale action programs. The book ends with four appendixes, of which the last one on nutrition program planning is especially promising.

A pioneering work such as Berg's cannot be perfect in all respects. There are a number of points which deserve consideration by the author when preparing a new edition. We have already pointed to the decision of the author, which in our view is adequate, not to describe quantitatively the present and future world food and nutrition situation. We have some doubts, however, whether it is equally adequate to give so little information on the quantitative aspects of new nutritional efforts and programs. If more quantitative data at the macro level on the amount of nutrients supplied in new programs, on the physiological impact and the economic implications of such programs were given, it would have been much easier to assess their potential effects.

In his evaluation of various agricultural programs, Berg shows particularly little enthusiasm for the production of animal protein. The reasons are understandable: the losses of physiological energy and digestible protein by conversion of plant products to animal products, the low purchasing power of the vulnerable groups, etc. Nevertheless, the generalizing conclusion: "Similarly ill-advised in most countries would be investment, for nutrition reasons, in traditional animal protein products" (p. 197) seems to overshoot the mark. It must be realized that the demand for animal products is increasing in many countries, that there are areas in all

countries which can be used economically only for cattle, sheep or goat grazing and that the low productivity of animals is not only based on feeding but also on genetically-inadequate stocks or bad hygienic conditions. All this calls for more specific efforts in animal production, even in countries with a dense population relying mainly on plant nutrients.

A last suggestion concerns Appendix D, "Nutrition Program Planning". This section is quite an interesting approach to a subject matter which will become more and more important. Perhaps it would have been better combined with the section on a systematic approach in Chapter Twelve, which does not belong in the strongest section of the book.

But these points do not impair, in any way, the great utility of the exercise. Berg's book belongs certainly to the category of "gap fillers". It should find a wide audience since it is well written and easily understandable to the interested amateur as well as helpful to the expert and planner. It convinces because the author has not only a clear concept but a thorough knowledge of the subject matter and of its social and economic environment and shows sound judgment.

P. von Blanckenburg

Berg, A. (portions with R.J. Muscat). 1973. The nutrition factor: its role in national development. The Brookings Institution, 1775 Massachusetts Ave., N.W., Washington, D.C. 20036, U.S.A. 290 pp. US \$8.95; paperbound \$3.50.

R. Bressani, J.E. Braham and M. Béhar, eds.:

NUTRITIONAL IMPROVEMENT OF MAIZE

The philosophy of this publication, and of the international conference on which it is based, is that since food habits are difficult to change, science and technology must strive to improve the nutritional quality of staple

foods by techniques which do not alter their character, utility or acceptability. The conference provided an excellent comprehensive overview of all the feasible and potentially useful ways that this can be

accomplished with maize.

The first of the five sessions of the conference (5 papers) stresses the importance of maize in human nutrition in the Americas and elsewhere, and the status of opaque-2 (high-lysine) corn in various regions. The second session (4 reports) reviews the technology and philosophy of fortification of maize flour in different ways and the third deals in detail with production, fortification and marketing of nutritionally-improved flour for arepas in certain Latin-American countries. The other sessions cover in similar detail tortilla production and nutritional improvement, improvement of corn foods in Africa and fortification possibilities with amino acids. In a final

session, a broader concept of food improvement beyond maize alone is presented, as well as two excellent summaries of the conference.

This initiative of INCAP in carrying out and publishing a comprehensive and authoritative review of what can be done to improve the nutritional quality of maize might well be emulated by similar attention to other major food staples.

Bressani, R., J.E. Braham and M. Béhar . (eds.). 1972. Nutritional improvement of maize. Proceedings of an international conference held at the Institute of Nutrition of Central America and Panama, Guatemala, 6-8 March 1972. INCAP Publication L-4. 317 pp.

R. C. Weast, ed.:

HANDBOOK OF CHEMISTRY AND PHYSICS

The fifty-fourth edition of this classic reference work is now available, the largest edition ever produced. The following sections have been revised, updated or expanded: properties of rare earth metals; miscellaneous mathematical constants; density of liquid elements; cryogenic properties of gases; key values for thermodynamics; limits of human exposure to air contaminants; commercial metals and alloys; thermoconductivity of the elements; conversion factors for units of thermoconductivity; photometric quantities; units and standards; absorption and velocity of sound in still air;

surface tension of liquid elements; diffusivities of gases in liquids; fixed point properties of oxygen; mass, dimensions and other related quantities of the earth; and strength of chemical bonds. The list of publications of the National Reference Data System has also been updated and expanded.

Weast, R. C. (ed.). 1973. Handbook of chemistry and physics, 54th edition. CRC Press, Inc., 18901 Cranwood Parkway, Cleveland, Ohio 44128, U. S. A. 2, 436 pp. US \$25.95.

L. Knutson, ed.:

ASTRA PROTEIN LETTER

This new publication of the Protein Division of the Astra Group of Sweden is distributed to government officials, workers in international relief organizations concerned with nutritional problems, protein researchers in universities and industry and others. There is no charge for the publication.

Special attention is given to fish protein, the nutritional field in which Astra is deeply engaged, but related areas are also covered.

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For further information please contact:

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Astra Nutrition
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NEW DISCOVERIES IN SORGHUM RESEARCH^{*}

Sorghum is the fourth most important cereal crop in the world, surpassed only by rice, wheat and corn. In some countries, notably in Africa, sorghum is the primary source of calories for tens of millions of people. One of sorghum's chief characteristics is that it can be grown on land that is comparatively dry and too infertile to grow other cereals.

It was to increase the protein quality of sorghum that Purdue University scientists began screening plant strains from the world collection. Two Ethiopian lines were found to have a 30 to 40 per cent increase in protein with about twice as much lysine and correspondingly improved amino acid balance, compared to commercially-grown sorghum.

The improved biological value of the newly-discovered high-lysine lines is controlled by a single gene, so that the improved grain quality can be easily incorporated by cross-breeding into sorghum varieties grown in the developing countries.

Purdue experiments also led to another major breakthrough, the discovery that tannin, a pigmentation chemical that gives the sorghum grain its dark color, somehow blocks the release of the protein. Tannin resides in an extremely thin layer under the skin of the kernel. Its presence is due to a single dominant gene, thereby making it easy to correct genetically. Removal of the tannin, however, would only serve to attract hungry birds. Research is continuing on this problem.

^{*}From "Front Lines", a publication of the U.S. Agency for International Development, Washington, D.C., Vol. 11, No. 23, 11 October 1973.

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC)^{*}

The following describes two recent research grants by IDRC (Canada) in India and Malaysia:

Development of better varieties of pigeon peas and chick peas

A grant of \$490,000 for this purpose has been made to the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad, India.

Pigeon pea, grown predominantly in India and Africa, is a woody shrub which produces pods over a prolonged period, usually two to three years. It has the qualities of surviving drought well and of being fairly free of disease.

However, it is thought likely that yields can be greatly increased if dwarf varieties can be bred that mature early and can be harvested at one time. The dwarf varieties could be used in improved intercropping systems with cereals, thus increasing the amount of production on smallholdings. Two or three crops might be produced during the same period that the traditional forms of pigeon pea are occupying the ground.

Chick pea, which is grown in the Middle East as well as India, has a deep root system and can therefore make use of residual moisture at the end of the rainy season or thrive as a winter crop in the cool season. However, it suffers from wilt and is susceptible to blight

and to a number of pests. Research to improve its resistance will be undertaken.

The two-year period of research covered by the grant will consist mainly of efforts to enlarge the present germ plasm collection of these crops and breed strains with improved qualities.

Fermentation processes for upgrading starches for use as animal feeds

A grant of \$86,404 has been made to the University of Malaya, Kuala Lumpur, Malaysia.

The expanding livestock industry of Malaysia has meant a greater demand for animal feeds, especially for poultry and pigs, two main sources of animal protein. One promising source of local feedstuffs is tapioca, also known as cassava or manioc.

Tapioca is fermented by various means in different countries in order to enrich it in terms of protein and vitamins, as well as to make it more digestible and palatable. Fermentation also helps reduce its toxicity by liberating the hydrogen cyanide in the root. The research project will study ways of upgrading the existing nitrogen by fermentation and of increasing the level of usable nitrogen to achieve better growth of the animals. The first method which will be studied is fermentation by means of fungal micro-organisms.

^{*} From IDRC News, Nos. 31/73 and 32/73, 4 and 10 October 1973 respectively.

MEETINGS

- | | | |
|--------------------|---|-----------------------------------|
| 6-9 November 1973 | <p>NUTRITIONAL ASPECTS OF COMMON BEANS
AND OTHER LEGUME SEEDS AS ANIMAL
AND HUMAN FOOD</p> <p>Contact: Dr. J. E. Dutra de Oliveira
Graduate School of Nutrition
Cornell University
Ithaca, N. Y. 14850, U. S. A.</p> | Ribeirão Preto,
Brazil |
| 6-9 November 1973 | <p>SEMINARIO INTERNACIONAL SOBRE LA
ALIMENTACION Y EL PROBLEMA PROTEICO
EN AMERICA LATINA</p> <p>Contact: Instituto Italo-Latino Americana
Piazza Guglielmo Marconi
00144 Rome, Italy</p> | Rome,
Italy |
| 7-9 November 1973 | <p>SYMPOSIUM ON SINGLE CELL PROTEIN</p> <p>Contact: Dr. P. Davis
Dept. of Food and Plant Sciences
Stanford Research Institute
Menlo Park, Calif. 94025, U. S. A.</p> | Rome,
Italy |
| 19-22 August 1974 | <p>WESTERN HEMISPHERE NUTRITION
CONGRESS IV</p> <p>Contact: Dr. P. L. White
Council on Foods and Nutrition
American Medical Association
535 N. Dearborn St.
Chicago, Ill. 60610, U. S. A.</p> | Miami Beach,
Florida, U. S. A. |
| 7-11 October 1974 | <p>FIRST INTERNATIONAL WORKING
CONFERENCE ON STORED - PRODUCT
ENTOMOLOGY</p> <p>Contact: Stored-Product Insects
Research and Development Laboratory,
ARS, USDA
P. O. Box 5125
Savannah, Georgia 31403, U. S. A.</p> | Savannah,
Georgia, U. S. A. |
| 15-17 October 1974 | <p>CONFERENCE DE L'HYGIENE ALIMENTAIRE</p> <p>Contact: Krajská Hygienická Stanice
CIDHA 74
Žerotínovo náměstí 3/5
60200 Brno, Czechoslovakia</p> | Brno,
Czechoslovakia |

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PAG STATEMENTS AVAILABLE

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2	Recommendation on aflatoxin	1969	
3	Nature and magnitude of the protein problem	1971	No. 12
4	Single cell protein	1970	No. 11
5	Marketing and distribution of protein-rich foods	1971	No. 12
6	Milk substitutes	1970	
7	Recommendation on prevention of food losses and protein-calorie malnutrition	1969	
8	Plant improvement by genetic means	1970	
9	Amino acid fortification of foods	1970	
10	A systems approach to the formulation and evaluation of nutrition intervention programs	1970	
11	Leaf protein concentrate	1970	
12	The world protein problem: research and development needs	1972	No. 12
13a	Review of the specific proposals contained in ACAST report "International Action to Avert the Impending Protein Crisis" United Nations, 1968	1971	
14	Marketing of conventional foods	1971	No. 12
15	Popular participation and community involvement in nutrition improvement programs	1971	
16	The potential of fish protein concentrate for developing countries	1971	Vol. II, Nos. 2 and 3
17	Low lactase activity and milk intake	1972	Vol. II, No. 2
18	Relationship of pre- and postnatal malnutrition in children to mental development, learning and behavior	1972	Vol. II, No. 2
19	Maintenance and improvement of nutritional quality of protein foods	1972	
20	The "protein problem"	1973	Vol. III, No. 1
21	Specifications for solvents	1972	
22	Upgrading human nutrition through the improvement of food legumes	1973	Vol. III, No. 2
23	Promotion of special foods (infant formula and processed protein foods) for vulnerable groups	1973	
24	The Green Revolution and protein supplies	1973	
25	The global maldistribution of protein: a growing trend	1973	Vol. III, No. 3
26	Food and nutrition considerations in national economic planning	1973	Vol. III, No. 4

PAG GUIDELINES AVAILABLE

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Published in PAG Bulletin</u>
2	Preparation of food-quality groundnut flour	1970	
4	Preparation of edible cottonseed protein concentrate	1970	
5	Edible, heat-processed soy grits and flour	1969	
6	Preclinical testing of novel sources of protein	1972	
7	Human testing of supplementary food mixtures	1972	Vol. III, No. 3
8	Protein-rich mixtures for use as weaning foods	1972	
9	Fish protein concentrate	1971	No. 12
10	Marketing of protein-rich foods in developing countries	1971	
11	Sanitary production and use of dry protein foods	1972	Vol. II, No. 3
12	Production of single cell protein for human consumption	1972	Vol. II, No. 2
13	Preparation of milk substitutes of vegetable origin and toned milk containing vegetable protein	1972	Vol. III, No. 1
14	Preparation of defatted edible sesame flour	1972	Vol. III, No. 1

PAG REPORTS AVAILABLE

1. Feeding the preschool child: report of a PAG ad hoc working group 1971
2. Manual on feeding infants and young children (Cameron and Hofvander) 1972

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- 2 Recomendación sobre la aflatoxina
- 3 Naturaleza y magnitud del problema de las proteínas
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- 18 Relación entre la malnutrición prenatal y posnatal y el desarrollo mental, el aprendizaje y la conducta

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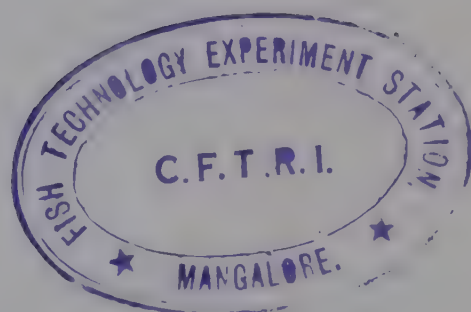
Déclarations

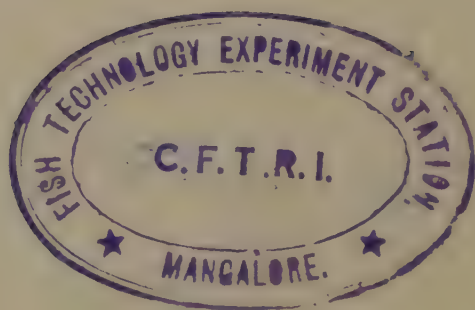
- 4 Protéines obtenues par la bio-synthèse d'organismes unicellulaires
- 9 Enrichissement en acides aminés des produits alimentaires
- 25 Mauvaise distribution mondiale des protéines tend à s'accroître

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